Proceedings of the Humber Waste Seminar 12 June 1997

Seafish Report No. SR505

September 1997

SEAFISH

The Sea Fish Industry Authority

Technology Division

Proceedings of the Humber Waste Seminar
12 June 1997

Report No: SR 505

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R. Watson

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Introduction

The fish processing industry developed around fishing ports at a time when landings were plentiful and there was little concern about the impact of mankind on the environment. Nowadays, natural resources and the environment are seen to be under threat and are becoming increasingly protected by law. Fishery control measures already limit landings; food safety measures affect the way fish is handled, processed and disposed of; environmental legislation, such as the Packaging Waste and Urban Waste Water Directives, will add greatly to the cost and difficulty of waste disposal. At the same time the fish industry is subject to intense competition within the food industry and margins are squeezed. It is inevitable that waste management will soon become a survival issue for many businesses and will be of major commercial importance to all.

Seafish studies suggest that for each tonne of fish caught, only one-third of a tonne is marketed as product for human consumption, whilst the majority of the remaining two-thirds of a tonne is dumped as total waste or as low value by-product. Much of it ends up as waste during processing.

The rising costs of water usage and effluent disposal, in particular, will present severe problems in the near future. Fish processors often use large volumes of water and similarly produce large volumes of effluent which may have a high level of organic contamination. Traditionally, the effluent in UK coastal regions, where the majority of the fish processing industry still remains, has been pumped out to sea at negligible cost. This will change as the Urban Waste Water Directive demands that by the end of 2001 this effluent must be treated. The water companies will have to pay for new sewage treatment works to be built, but these costs will ultimately be passed on to companies which discharge to the public sewers, either through increased trade effluent charges or, alternatively, by setting relatively low consents to discharge in order to discourage the disposal of high strength effluent. If a very low consent to discharge is set the fish industry will have to take on responsibility for treating its own effluent, which may drive some processors out of business.

There are many reasons why the whole waste issue should be treated as a serious and urgent matter, perhaps the most real of which is increasing costs. It is inevitable that every company will be affected in some way or another. There is seen to be considerable potential for reducing total wastage and gaining more value from co-products, thus offsetting the increasing costs of waste disposal. Waste minimisation offers the opportunity to minimise these disposal costs and can help to maximise company profits.

To address these issues Seafish has been working with Yorkshire Enterprise Ltd. and technical consultants to carry out an ERDF funded waste minimisation project on the banks of the Humber. The first stage of that project was a series of waste reviews of about 50 small or medium sized fish businesses. Each business was reported to confidentially but on 12 June 1997 a seminar was held in Grimsby to present and discuss the broad findings of that work.

This collection of papers from that seminar aims to provide an introduction to the relevant waste minimisation issues and highlights the areas within a typical primary processing operation where waste minimisation opportunities can be put into practice.

Keynote Introduction

K. Beeken - Grimsby Fish Merchants' Association

The importance of looking at and considering the way in which all companies deal with their waste cannot be emphasised enough. There is no doubt that over the next 2-3 years the costs associated with dealing with energy and waste will increase, and at an alarming rate, unless we all take care in ensuring that we try and keep it to a minimum. It is in everyone's interest to deal with the whole waste issue as a serious and urgent matter.

Paper 1

The Importance of Waste Minimisation

R.B. Watson - Seafish

Introduction

This paper aims to highlight the importance of waste minimisation. It introduces the four main areas where waste minimisation can be implemented, laying the foundation for the following talks which cover each subject area in more detail.

What is Waste Minimisation?

Waste minimisation is the systematic process of reducing waste at source. A great deal can be achieved using 'no cost' or 'low cost' methods.

There are many reasons to reduce waste in our industry. Fish is a valuable but limited resource. With continued overfishing, a high level of discards and black fish landings, the resource is under threat and processors should aim to make the most of the limited amount of fish that is likely to be landed in the near future. In addition there is increasing public awareness and pressure from environmental legislation to reduce waste. However, in most cases the most powerful motivation to reduce waste is the opportunity to maximise profits. For some businesses, the money saved from implementing waste minimisation will be a welcome bonus, but for many, waste minimisation will become a survival issue.

Waste minimisation can be especially lucrative when applied to the following four areas:

- Raw materials
- Water
- Effluent
- Energy

Raw Materials

The true cost associated with raw material wastage not only consists of the cost of the raw material itself, but also the cost of disposing of the waste or effluent generated! A great deal can be achieved through simple 'low cost' or 'no cost' initiatives. Staff education can reduce the amount of raw materials ending up down the drain or in the fishmeal bin. In many cases trimmings, heads, cheeks, flaps, tongues etc can be used to produce products of useful value.

Water

The overall cost of water is often overlooked. In the Hull and Grimsby areas, the costs of supply varies from 64.2p/m^3 to 69.8p/m^3. To demonstrate how disposal costs are often ignored, the water from a continually running 1in hose (in use or an equivalent leak) would cost approximately £10,000 per year in water costs alone. When disposal costs are taken into consideration, this raises the total cost of that water to approximately £30,000 per year.

A recent Seafish survey showed that the water used by white fish processors varied between 0.7m^3 and 13m^3 per 1 tonne of product. Average water use was 5m^3 /tonne of product. Even allowing for differences in operations, there is clearly scope for reducing the water consumption of many businesses through the education of staff (not to wire up spray triggers, etc), leak checks, bill checking and simple water saving devices.

Effluent

The Urban Waste Water Directive (91/271/EEC) (implemented by 1 January 2001) will control the strength of effluent discharged into EU waters. Around the country new coastal sewage treatment plants are under construction to treat effluent before discharge into the sea. The plant in Grimsby is expected to cost about £30m whilst that in Hull is likely to cost about £200m.

At the moment many coastal processors only pay reception and conveyance charges as the effluent is discharged directly into the sea. In future, charges will take into account the organic strength of the effluent as determined by the chemical oxygen demand (COD) test and the amount of suspended solid material (SS) present. When these charges come into force, trade effluent charges are expected to increase by 400-500% from about 30p/m^3 to £1.40m^3. This will bring coastal processors into line with the charges already faced by inland factories.

A recent Seafish survey showed that the strength of effluent produced by white fish processors varied from 250 mg/l to 8,700 mg/l COD. Even allowing for differences in processing techniques, there is significant scope in many businesses for reducing effluent strength at source, through the education of staff (not to sweep waste into drains) and by changing working practices and equipment. In addition, simple effluent treatment equipment such as screens can be used to prevent solid material escaping into the sewer.

Energy

Independent surveys have shown that energy efficient businesses can pay up to 9 times less for energy than their counterparts. Typically 20% savings are possible on refrigeration equipment, obtained through regular maintenance and correct operation. Variable speed motor drives can save up to 45% on motor running costs and boiler/steam costs can often be reduced by up to 50%.

Help and Assistance with Minimising Waste

As well as information from Seafish, environmental consultants and local organisations such as the Humber Resource Efficiency Centre, the Environmental Technology Best Practice Programme (ETBPP: 0800 585794) offers a range of FREE SERVICES, including:

- Environmental help line
- Counselling visits for small/medium sized businesses
- Events and workshops
- Published information and guides on all aspects of waste/energy and water minimisation.

Paper 2

The Current Waste Minimisation Project

M. Archer - Seafish
(presented by Dr R.A.Allen)

The aim of the project is to evaluate the current situation of fish processing companies with respect to their environmental performance. This will then to lead to a more in-depth study of water usage and contamination in a representative sample of companies, with an investigation into how to reduce both water consumption and effluent production.

The project was instigated by the Sea Fish Industry Authority and has been developed in conjunction with Yorkshire Enterprise and two environmental consultancies, Montgomery Watson and Business Development Group-North. It has been planned in three main phases, with a fourth voluntary phase.

Phase I

In order for the project to succeed a number of qualifying companies, working in the fish industry, were required. This was arranged through the Grimsby and Hull Fish Merchants' Associations. To qualify for participation in the project, a company had to be based in the eligible area, employ 250 people or less and have a sales turnover, in the last financial year, of less than £30 million. This would class them as small to medium enterprises (SME's).

Each company, which replied to the request to be involved, received a free waste review for their premises. This included evaluating energy, water and solid wastes and identifying areas for improvements. Approximately fifty companies have been reviewed and reports made to each.

This phase of the project was carried out by technicians from both of the environmental consultancies.

Phase II

Phase II involves choosing ten representative companies, from all those reviewed, and undertaking more detailed studies of water usage and misuse in each. In addition, water minimisation techniques will be evaluated in order to discover the most appropriate methods for these companies to reduce their water consumption and minimise future effluent charges. Reports will be made to each company involved.

This will be a free service to these ten companies and will be undertaken by Seafish staff and consultants from Montgomery Watson.

Phase III

This will be undertaken independently of the companies involved, using all the findings of the more detailed water audits. It will include the production of guidelines, recommendations and information sheets which will assist fish processing companies in carrying out their own water audits. They will include practical recommendations which companies will be able to implement in order to make water and effluent savings.

This guidance will be available through Seafish to the whole of the UK fish processing industry. It will be written by Seafish staff, with some assistance from Montgomery Watson.

Phase IV

This will be undertaken independently of Seafish and will include projects specific to any companies which qualify for funding. A 50% grant may be available from Yorkshire Enterprise for those companies which apply.

This phase will be undertaken by Montgomery Watson.

Paper 3

The Project Funding

Carol Fereday - Yorkshire Enterprise

Yorkshire Enterprise have organised the provision of funding for consultants to be included in this project, through their Technology Scheme, which is part of Profit 3000. Profit 3000 is a European grant which contributes 50% of the cost of using specialists and consultants to give businesses a hand in solving a whole range of problems.

If you have a problem of any description Profit 3000 can help you work out the best way forward, by providing an approved specialist to come and talk to you, at no initial charge to yourself.

If you then decide you want to do something our specialist can work out a plan of action and get a 50% grant to see it through to completion. You will need to decide soon as it's on a first come first served basis.

Profit 3000 is a European grant which contributes 50% of the cost of using specialists and consultants to give your business a hand in several main areas:

- *Quality Systems*
  It can help you to achieve certification to a relevant quality standard such as ISO 9000. You can then profit through improved efficiency and customer satisfaction.

- *Environmental Action*
  You can address environmental issues which affect your business's performance and profit from waste reduction and energy savings.

- *Technological Investments*
  You can improve utilisation of new and existing technology and profit through its implementation.

- *Marketing Support*
  Profit from promoting your company through expert advice on individual full colour brochures.

- *Management Accounting and Secretarial Service*
  You can receive specialist assistance over 12 months and profit through improved financial systems.

- *Management Timeshare*
  Profit from growth by solving your business problems with the help of an experienced manager or specialist.

You are eligible for Profit 3000 if you:

- are located in the region of Yorkshire and North Lincolnshire,

- employ 250 people or less,

- have a sales turnover of less than £30 million in the last financial year,
- even if your business is part of a group which employs more than 250 people you may be eligible if the groups holding in your business does not exceed 25%.

For further information contact:

The Business Development Group North
Queensway Business Centre
Dunlop Way
Scunthorpe
DN16 3RH

Tel 01724 279499
Fax 01724 279599

Profit 3000 is part financed by the
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and managed by Yorkshire Enterprise

Paper 4

The Companies Reviewed so Far

M.Archer - Seafish
(presented by I.Boyd - BDG North)

Overall, 68 qualifying companies in the Grimsby and Hull areas were contacted during the initial phase of the project. However, preliminary waste surveys have been undertaken in only 42 of these. 11 companies rejected the offer of a free survey and at the time of the seminar 8 companies were undecided, or expressed an interest to participate at a later date.

Although 42 companies had participated in the study at the time of the seminar, information was available from only 36.

Qualifying companies in both Hull and Grimsby were approached and asked to participate in this study. As can be seen from Table 1 below the majority are located in Grimsby.

Table 1 - The location of companies who participated in the waste surveys

Location of Companies	Number
Grimsby	26
Hull	10

The size of the companies involved, in terms of both annual turnover and number of employees, varied significantly. As can be seen from Table 2 the majority of the companies which were included in the initial waste surveys had an annual turnover of less than £5 million. The number of employees is also an indicator of size and, as can be seen from Table 3, over half of the companies involved employed less than 20 people.

Table 2 - The size of the companies, in terms of annual turnover

Annual Turnover (£ million)	Number of Companies
less than 5	19
5 to 10	3
greater than 10	3
unknown	11

Table 3 - the size of the companies, in terms of number of employees

Number of Employees	Number of Companies
less than 20	23
21 to 40	7
more than 41	6

The majority of companies who participated in these waste surveys are processing units. Table 4 gives a breakdown of the types of activities that the companies were involved in.

Table 4 - The types of activities that were undertaken by the companies involved in the waste surveys

Activity	Number of Companies
Filleting (including skinning)	22
Filleting & smoking	10
Filleting & other value added processing	3
Wholesaling	1

Paper 5

Water Usage & Minimisation in Fish Processing

G. Howard - Montgomery Watson

These notes summarise the findings of a set of initial waste surveys carried out for the Sea Fish Industry Authority by Montgomery Watson. The figures used are those generated from the reports on these initial surveys and should be used for guidance only. A second phase of work will follow, in which the figures will be further refined.

Is the current water usage good or poor?

For any waste minimisation programme to work, the management need to have an idea of how much of a commodity is being used. The table below summarises initial findings of how much fish is produced in respect of the volume of water used. (Appendix I includes different parameters to suit different methods of calculation).

Performance	Weight of fillet produced per m^3 of water used	
	Stone	kg
Poor	<10	<65
Average	10 - 25	65 - 160
Good	>25	>160

Good - These processors are using the lowest amount of water per weight of product produced, even before waste minimisation practices have been applied.

Poor - At the start of this scheme these processors are using at least two and a half times that which the best operators are using.

In order to calculate how you compare, you can look at your last water bill and establish how much water you used. You will also need to know the tonnage of fish produced in that same period. Alternatively, you can use a daily reading of the water meter and the weight of fillets produced in that same day. Using these figures you can use the following equation to ascertain the weight of fish processed per m^3 of water.

$$\frac{\text{Weight of fillet produced}}{m^3 \text{ of water used}}$$

Once the waste minimisation process has been undertaken the amount of product produced per m^3 of water would be expected to increase.

Problems Identified

Overall, the waste surveys identified specific areas where water was being overused and where effluent production could have been avoided.

Water Usage - The more water you use the higher your charges will be. Charges will be increasing every year so costs will carry on going up and up. Problems identified in the waste surveys included;

- Floors were seen to be awash with water - is this a necessary part of processing?
- Uncontrolled / open ended hose pipes were used in many premises, this often leads to a lot more water used than is necessary.
- Water was seen to be left running even when not required.
- Spray guns / trigger hoses were adapted so that they flowed continuously. Many were left running at maximum, thus defeating their overall objective to reduce water flow.

Effluent Production - The stronger the effluent, the higher the effluent charges will be when they come into force. It is therefore important to try and minimise solids going down the drain. Problems identified in the waste surveys included;

- Filter baskets were not in use or had been removed - these are vital in preventing large solids from entering the drains.
- Filter baskets were seen to be full of solids, indicating that they had not been cleaned for some time - it is important not to leave solids in waste water for long periods of time.
- Solid matter was being discharged to the drain, which in some cases resulted in blockages - again it is important to prevent as much solid matter from entering the drain as possible.

Reducing the Water Usage

From the initial surveys that were undertaken the following areas appear to be most likely to create initial savings, however, some of these may prove to be controversial!

- Installing a flow meter on each of the filleting lines and measuring the resulting flows will show the variation in water use between filleters. It will also give immediate feedback to staff on how much water they personally use.

- During the winter the water is cooler and the fish take longer to defrost, or are generally colder. Many filleters used lots of cold water to prevent their hands from becoming too cold and inflexible. In the surveys, one company uses a bucket of warm water at the side of the filleting tubs to keep hands supple, rather than using vast amounts of cold water.

- Many hose guns are of a similar design and can be opened to run continuously, with the disadvantage that some operators wire them to remain in the open position. Guns with a set flow are an alternative and these could help to minimise water usage.

- Pre-set flow restrictors may be an option when trigger hoses are persistently wired up. In this case a restrictor is set into the line, out of sight, with a pre-set flow rate. One company had this, in conjunction with variable flow restrictors to the filleting tubs. This gave the filleters the impression that they could vary the flow rate, however, they could only do so within a limited flow.

- Perhaps retraining would be a useful method. Employees could be shown that less water is needed than they currently use. However, it must be realised that totally dry-filleting is impractical as the knife will not slide over the fish. An intermediate level of water usage must be found.

- Another option to reduce water usage would be to give filleters a water allowance per stone of fish processed. If they were then metered, the filleters could be charged for any excess water above their allowance. To make reduction an incentive, if the level were set and actual usage is below this level, the filleters could be given a bonus, based on the amount of water saved.

- With defrosting, cold water is often poured or sprayed over the fish to accelerate the defrosting. Hot water or steam could be mixed with colder water to give the optimum temperature for defrosting, without damaging the fish. Alternatively, there are mechanical means of defrosting fish which would greatly reduce the need for water.

- As a simple option you should ensure that any mechanical processing equipment is running efficiently, in terms of the product and the volume of water used, in order to try and reduce the water consumption.

Reducing the Effluent Bill

Companies generally pay two separate water costs; the initial purchase of the clean water and the subsequent payment for the effluent disposal (different rates apply to the disposal of trade and domestic effluents). In the future, water companies will be charging businesses using the Mogden formula as a basis. The amount which you will pay will depend on the strength and volume of effluent produced. Without undertaking any waste minimisation, processors in Hull have been given reduced trade effluent bills for the following reasons:

- ice production,
- glazing, and
- battering.

In the production of the above, water is taken out of the building in or around the product, therefore it is not entering the sewage system. Thus, if a company can prove how much water is being transported off-site they may not be charged for it.

In Hull, Yorkshire Water will give these concessions without requiring sub-metering for smaller users.

In Grimsby, ABP are willing to look at this issue if the processors can provide proof that there is an actual reduction in the amount of trade effluent produced. ABP seem to be taking this stand so that they can negotiate confidently with Anglian Water.

The best way of obtaining proof of this reduction is to fit a meter to both the influent and waste flows from a unit. For ice, the effluent bill can typically be reduced by approximately 10%. The cost of the meter is approximately £50, excluding installation.

You should, therefore, check your effluent bills to try and get reductions if they apply to you.

Ways of Reducing the Strength of the Effluent

- Prevent pieces of fish falling on the floor. Once on the floor the fish is often broken up, either under foot or by pallet trucks. In the drain these smaller pieces of fish are much more difficult to remove from the effluent, and can make a significant contribution to the effluent strength.

- Install filter baskets in drains at strategic points to ensure that the majority of solid waste does not enter the drainage channel. The size of the aperture must allow water to flow through, whilst preventing a majority of the solids from entering the drain.

- Regularly clean the filter baskets to ensure that the solid matter is not left for long periods in the waste water. This will also help to reduce the strength of the effluent.

- Ensure that mechanical processing equipment is working efficiently, in an attempt to reduce the production of waste material.

- Simple effluent treatment equipment can be very effective at reducing the strength of the effluent before it is discharged.

- Larger companies producing a significant amount of higher strength effluent may find more sophisticated effluent treatment equipment such as dissolved air flotation (DAF) to be cost effective.

Appendix I

Stone of fillets produced per m^3 of water used

Performance	Stone of fillets produced per m^3 of water used
Poor	less than 10
Average	10 to 25
Good	greater than 25

Kg of fillets produced per m^3 of water used

Performance	kg of fillets produced per m^3 of water used
Poor	less than 65
Average	65 to 160
Good	greater than 160

Litres of water used per stone of fillets produced

Performance	litres of water used per stone of fillets produced
Poor	greater than 100
Average	100 to 40
Good	less than 40

M^3 of water used per tonne of fillets produced

Performance	m^3 of water used per tonne of fillets produced
Poor	greater than 15
Average	15 to 6
Good	less than 6

Paper 6

Energy Usage and Misusage

R. Watson/M. Archer - Seafish
(presented by I. Boyd, BDG North)

For many companies minimising energy costs can be very lucrative. Businesses which use large refrigeration systems or boilers in particular, can often make significant savings.

Making a start

The basic principles for implementing an effective energy minimisation programme are detailed below:

- Commitment from senior management is essential to ensure the project is carried through to completion.
- An energy audit can then be carried out to determine where and how much energy is used.
- Identify the problem areas where waste occurs. Use brainstorming sessions to identify and implement solutions. Often a great deal can be achieved by using no cost, or low cost methods such as the education and training of staff and simple energy saving devices. For more expensive solutions the overall cost must be weighed up against the long term benefits to the business.
- Establish action plans to assist in the monitoring and revision of targets in order to make further savings in the future.

Areas where energy may be wasted

In the recent waste surveys some of the areas where energy was being wasted are highlighted below:

- Reliance on artificial light.
- Old and inefficient lighting.
- Lights/heating left on in unused areas.
- Incorrectly set or inefficient time clocks.
- Equipment left on when not in operation.
- Inadequate insulation on pipes and boilers.

Some possible solutions to reducing energy costs

Simple measures can often be very effective when attempting to improve energy efficiency.

- Analyse your service charges. Check that the best tariff option is being used. Large users may be able to negotiate special prices directly with the utilities.

- Educate staff to turn off lights and equipment when not in use.
- Use sensors in low occupancy areas to switch lights on only when required.
- Make the most of artificial light.
- Check (and replace if necessary) timer controls to ensure that heating is only on when required.
- Variable speed motor drives can save 45% on motor running costs.
- Boiler/steam losses can often be reduced by 50% through insulation and new efficient boilers.

Refrigeration systems

Refrigeration is one of the main areas where energy savings can be made. Typically, refrigeration costs can often be reduced by 20%. The following tables highlight some of the areas where refrigeration systems can become inefficient. Many of the solutions can be implemented with little or no cost to the business and most have an anticipated payback period of less than 2 years.

Reducing Refrigeration Energy Costs

☺☺ Indicates a particularly effective solution.

System Load

Question	Energy Efficiency Measure	No Cost	Cost
Is the product warmer than necessary when it enters the refrigerated space?	Good management/housekeeping should prevent this.	☺☺	
Is the temperature of the refrigerated space colder than necessary?	The temperature should not be lower than necessary. Adjust the thermostat; a 1°C increase in temperature gives a 2-4% saving in energy.	☺☺	
Does heat go into the refrigerated space unnecessarily?	Doors should not be left open longer than necessary.	☺☺	
	Strip curtains, automatic doors or night blinds can be fitted to reduce warm air ingress.		☺☺
	Damaged door seals should be replaced.		☺☺
	Thin or damaged insulation should be replaced or repaired.		☺
Is the refrigerated space occupied unnecessarily?	Ensure loading/unloading is as fast as possible.	☺☺	
Do motors, lights or pumps heat the refrigerated space?	Energy efficient lighting, fans etc cost less to run and produce less heat in your cold store.		☺
	It may be possible to relocate pumps and motors outside the refrigerated space.		☺

Refrigerant

Question	Energy Efficiency Measure	No Cost	Cost
Does the system leak refrigerant?	An undercharged plant consumes more energy - the leaks should be found and repaired.		☺☺
Does the plant use a CFC refrigerant?	These are no longer produced and a replacement strategy will be necessary for some plants. Several alternative refrigerants are available. Take the opportunity to make other energy efficiency improvements when converting your plant.		☺

Condensor/Evaporator

Question	Energy Efficiency Measures	No Cost	Cost
Is the evaporator working efficiently?	The evaporator should not be blocked with dirt - if necessary clean it.	☺☺	
Is the condensing temperature higher than necessary?	A blocked condenser should be cleaned.	☺☺	
	If the condensing temperature is held artificially high regardless of the ambient temperature it may be possible to reduce the pressure at which it is maintained, or to eliminate it altogether (replacing the thermostatic expansion valve with an electronic type may be cost-effective).		☺
	If the sun shines onto the (air cooled) condenser face the condenser should be relocated out of direct sunlight or shaded.		☺

Suction/Liquid Temperatures

Question	Energy Efficiency Measure	No Cost	Cost
Is the suction line temperature higher than necessary?	Heat picked up by the suction line wastes energy. This line should be insulated, if the insulation is damaged or missing then repair or replace it.		☺
	If the line is routed through a hot area it should be re-routed if possible.		☺
Is the liquid line temperature as low as possible	Heat picked up by the liquid line wastes energy. If the line is routed through a hot area re-route if possible.		☺

Defrosting

Question	Energy Efficiency Measure	No Cost	Cost
Is the evaporator usually iced up?	The defrost timing may need to be adjusted.		☺☺
	A defrost on demand system ensures defrosting is carried out when necessary and for the correct time.		☺☺
Is the evaporator drain-pan and/or line iced up?	Defrost heaters, drain-pan heaters and/or drain line heaters may need replacing.		☺☺

Compressors

Question	Energy Efficiency Measure	No Cost	Cost
Does the compressor have in-built capacity control?	Minimise or eliminate the use of in-built capacity control - it is more efficient to switch the compressors on and off to match load variations.		☺☺
Is the compressors the most efficient for the job?	It may be worth replacing an inefficient compressor with a more appropriate type.		☺

Fans

Question	Energy Efficiency Measure	No cost	Cost
Is the fan duty variable?	The use of two speed or multi speed fans reduces energy use.		☺

System Control

Question	Energy Efficiency Measure	No cost	Cost
Can you make better use of your system control?	Ensure that; - evaporating temperature is as high as possible; - condensing pressure is as low as possible; - compressors operate on in-built capacity control as little as possible Control settings can usually be adjusted to achieve the above without reducing reliability.		☺☺

Paper 7

Making the Most of Your Raw Materials

T. Salmon - Montgomery Watson

Waste or opportunity?

There are many words that we use to describe waste. Just because it has a different name, does not mean it isn't waste. Commonly used alternatives include rubbish, offcuts, packaging, dregs and effluent. If we allow these materials to go down the drain or enter a skip then we are discarding it as waste. Preventing this provides an opportunity to increase profits ie. through improvements in efficiency, quality and environmental performance.

What does it take?

a) Consideration.

It is often the case that when one is asked "*Why do you do it like this?*" the reply is "*because that is the way it has always been done.*" It is important to consider whether this is still the most efficient way or whether there are now alternatives i.e. best practices 10 years ago may not be best practices today, when taking into account changing legislation and technology. These inevitably lead to changing costs and options.

As an example, expanded polystyrene packaging is widely used in the fish industry for packaging, primarily for its good insulative properties. Although it is very bulky to store and difficult to dispose of it has remained the main packaging material for transporting fresh fish or fillets. However, with the new Packaging Waste Directive, increasing producer responsibility, alternative box materials and an improved cold chain distribution system other types of packaging may now prove to be a better alternative in some cases.

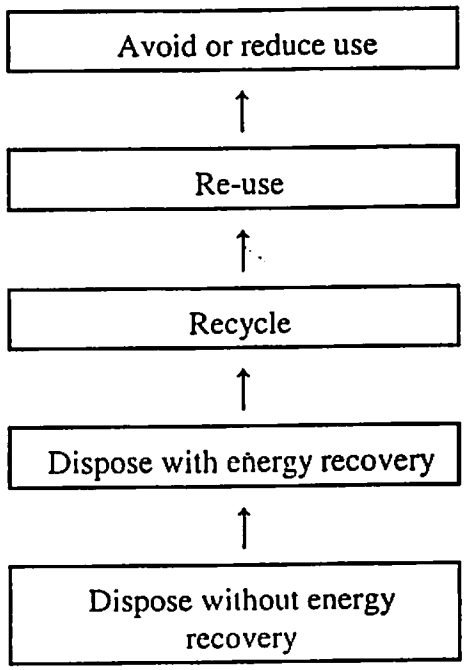
b) Communication

Yours is not the only company which has a waste management problem. The Landfill Tax and Packaging Directive are two examples of legislation which are spurring people to look at ways to solve waste management issues. Communication between companies is vital in trying to find the best solution.

c) Results

Every company wants the same result ie. an increase in profits.

The waste management hierarchy



For all of the waste which you currently produce, consider where it is within this waste management hierarchy. Generally, the closer to the top you are the greater the profit, efficiency and quality of your company will be. Is it possible that with a few small changes in your working practices and procedures that some of your waste streams can be moved into a higher category, thus further improving the profit, efficiency and quality of your company.

Fish by-products

The main fish by-products are:

- head & frame,
- fins,
- tongue & cheeks,
- skin,
- v-cut,
- flaps & lugs.

These materials account for approximately 58% of a fish, by weight, and have certainly been used as an opportunity rather than waste. However, these basic environmental reviews have highlighted the considerable variations between the companies which were assessed. These differences mainly include the separation of different by-products for different usage and value. It has been noticed that material which is sold as offal varies between companies. Some companies will include the head (with the tongue & cheeks removed) and frame whereas others will include all of the fish minus the actual fillet. How does your company compare with this, are you potentially wasting a valuable part of the fish? Are there other companies which will

accept your fish frames for further processing? One of the findings of the audits included discovering a company which sells its waste fish heads to another company which removes the tongue and cheeks for further sale. Remember the saying "One man's waste is another's raw material."

Other materials

Examples of other materials commonly used by fish processing companies include the following:

- incoming & outgoing food packaging,
- cooking oils,
- sauce/crumb mix,
- cleaning products & packaging,
- office paper.

Are there any opportunities in your business for utilising the waste produced by these activities, or can this waste be reduced in the first place by changing operating or management procedures. As an example there is a company in the Humber region which will recycle waste cooking oils, but is there a way of reducing the oil usage in order to minimise any wastage. Is there a way of changing the quantities of ingredients or other products purchased in order to reduce the amount of waste packaging that ends up in the refuse skip? Simple ideas like this can often result in significant cost savings over a period of time.

Paper 8

Some Possible Answers

R.B. Watson - Seafish
(presented by Dr. R.A. Allen)

Introduction

New environmental legislation will result in many coastal fish processors facing dramatically increased effluent charges. In future, these processors will be charged on the strength of their effluent. Simple waste minimisation and utilisation techniques can save money by reducing effluent, water, energy and raw material costs; in some cases valuable by-products can even be recovered.

This paper summarises the stages of implementing a successful waste minimisation programme. Details of some of the practical steps which can be taken to start reducing water, raw material and energy costs, are discussed.

Once a waste minimisation programme is up and running, simple "end of pipe" effluent treatment equipment can then be used to reduce disposal costs and in some cases recover valuable by-products.

Stages of Waste Minimisation

1. Authorise it!

The first step *must* be to ensure that the most senior management within the company is willing to take the leading role by establishing an agreed company policy and strategy. This will ensure management commitment, provision of adequate time and resources, training and encouragement for the completion of projects.

2. Measure it!

It is impossible to control something which has not been measured. Carry out a detailed water audit to determine exactly where and how much water is used and the location volume and strength of effluent produced. Water leaks can be detected by reading meters overnight. Similar audits can also be carried out for energy and raw materials usage.

3. Minimise it!

Use brainstorming sessions to identify the key areas where waste is produced and plan a minimisation strategy to reduce it. Educate and involve staff ; set responsibilities for given areas of the project. Change cleaning schedules to ensure solid waste, i.e. pieces of trimmed fish, end up in the fishmeal bin, not down the drain, by ensuring baskets and traps are in place and regularly cleaned.

Check water bills and tariffs. Seafish recently identified the opportunity to save approximately £1,500 per year by switching to the correct trade effluent tariff in one of its buildings! Check

that equipment such as defrosters and skinning machines are using the correct amount of water, as per the manufacturers' recommendations. Can the water supply to the machine be reduced whilst still maintaining effective, safe and hygienic operation? Install simple water saving devices such as spray guns and flow restrictors. Repair any leaking pipe-work.

Refrigeration and freezing equipment should be serviced regularly to maintain the correct level of refrigerant. Ensure doors are not left open for longer than necessary and that adequate insulation is provided. When purchasing equipment specify energy efficient motors and variable speed motor drives where appropriate.

4. Review it!

Waste minimisation is a continual process. Regularly review the systems already in place. Inform all staff of the success of the initiatives and continue brainstorming sessions to identify new areas to reduce waste.

Some End of Pipe Solutions for Reducing Effluent Strength

In future, all effluent treatment charges will take into account the organic strength of the effluent, the stronger the effluent the higher the charge. Fish processors in some areas may be subject to very low consents to discharge. Effluent treatment technology is available to reduce the strength of the effluent discharged, allowing businesses to reduce charges and meet discharge consents.

For simplicity, fish processing effluent can be thought of as containing two components; dissolved organic material such as blood and proteins and suspended material such as small pieces of fish, oils and fats. Dissolved solids are difficult to remove and require sophisticated equipment with a high capital cost. Suspended solids however, are more easily removed by screening or dissolved air flotation (DAF) equipment.

Only when all the waste minimisation projects have been implemented should end of pipe treatments be investigated. Seafish have trialed some of the more suitable equipment to determine its effectiveness on fish processing effluent.

Screens

Screens are a simple but effective way of removing solids from the effluent before it enters the drain. There are many different screen designs including rotary and run-down screens, some of which may be self cleaning (Figs. 1 and 2). Simple bar or perforated drum screens are relatively inexpensive but have a tendency to block when small apertures are used. More efficient designs use a "wedge wire" screen which is less prone to blocking, allowing much smaller particles to be removed. Recent Seafish trials using a rotary wedge wire screen reduced the strength of herring (in roe) processing effluent by up to 30%-40%. It is estimated that a 10%-20% reduction in effluent strength could be achieved with some types of white fish processing effluent.

Dissolved Air Flotation (DAF)

DAF equipment uses microscopic air bubbles to float out the fine suspended solids and oils/greases from screened effluent (Fig. 3). Although this type of equipment requires a high

capital investment, trials have shown that some fish processing effluents can be reduced in strength by 80%. In larger companies producing a high volume of high strength effluent, the pay back period may be as short as six months.

Biological Treatment

In some special cases, where a low consent to discharge has been imposed, i.e. discharge directly into the sea or a sensitive water course, biological treatment may be required. Seafish are currently investigating the types of equipment available.

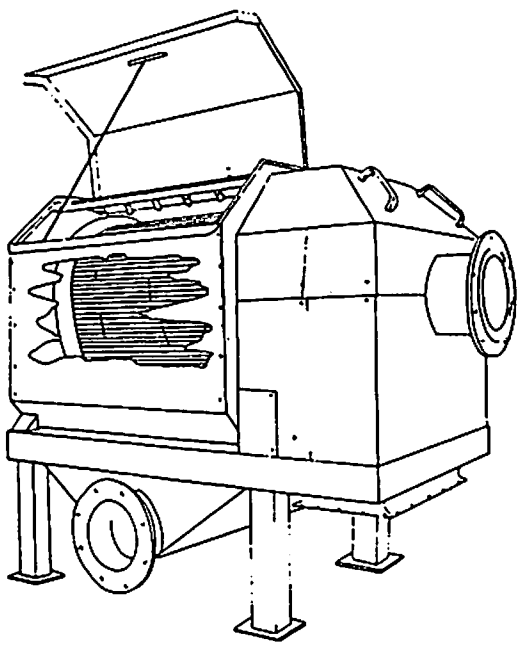


Figure 1 - Wedge wire rotary drum screen

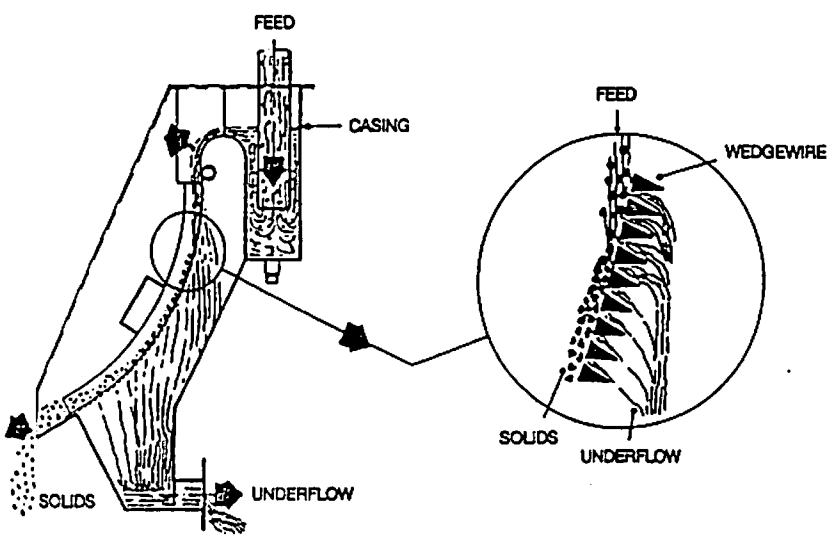


Figure 2 - Wedge wire run-down or 'J' screen

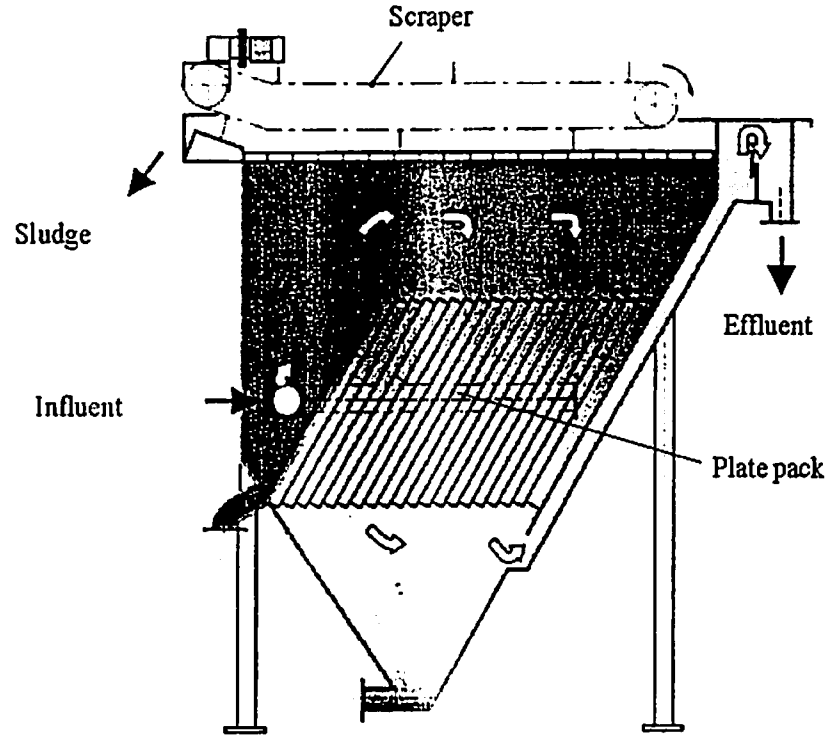


Figure 3 -Dissolved air flotation

Paper 9

The Producer Responsibility Obligations (Packaging Waste) Regulations

M. Archer - Seafish

In response to the EU Directive 94/62/EC on packaging waste, the UK Government has introduced the Producer Responsibility (Packaging Waste) Regulations which came into force on 6th March 1997.

What are the Regulations?

The Regulations are aimed at enabling England, Wales and Scotland (separate Regulations will apply in Northern Ireland) to meet EU targets for the recovery and recycling of packaging waste materials. The Regulations require that by July 2001 at least 52% of all packaging (by weight) must be recovered, i.e. recycled, composted or incinerated for energy recovery. A minimum of 16%, by weight, of the packaging materials - paper, plastics, aluminium, steel and glass - must be recycled. Wood and other packaging materials will be included towards the recovery obligation from January 2000.

The Regulations also set interim targets. During 1998 and 1999 targets for recovery and recycling are 38% and 7% respectively. During 2000 these targets increase to 43% and 11%.

Who is affected?

The obligations in the Regulations apply to businesses across the packaging chain which supply packaging or packaging materials to the UK market. The definition of packaging is taken from the EU Directive and encompasses primary packaging, secondary packaging and tertiary packaging.

The Regulations directly apply to businesses that handle over 50 tonnes of relevant packaging in a year and which have a turnover of £1 million or more. However, businesses with a turnover of less than £5 million will be exempt until 1st January 2000. Similarly, the wholesaler obligation does not apply until this date.

Businesses are placed in one or more of the following classes of producer according to the relevant activities they perform:

- packaging materials manufacture 6%
- conversion of those materials into packaging 11%
- packing / filling, and 36%
- retailing to the final user or consumer of the packaging 47%

The percentage weighting relates to the proportion of packaging handled for which that sector is deemed to be responsible. Importers and wholesalers are also dealt with separately in the Regulations but not as main activities. A business is caught if it supplied packaging or

packaging materials in the preceding year to any other producer, distributor, or user or consumer.

What must be done and by when?

a) Register or join a scheme

If you believe your business is affected then you must register with an official agency or compliance scheme before 31st August, 1997. In subsequent years you must re-register on 1st April.

If you wish to undertake responsibility for your own recovery and recycling then you must register with the Environment Agency, for businesses registered in England or Wales, or the Scottish Environmental Protection Agency for businesses registered in Scotland. With this option you will take full responsibility for locating the appropriate quantities of waste and for the recovery and recycling of that waste.

Alternatively, you can join an industry-led collective scheme, such as Valpak. Such schemes will organise collection, sorting and recycling of waste and will take responsibility for meeting the aggregate obligations of their members.

Both of these options incur financial costs. With the individual route you will pay £750 per annum to the Agency and incur the full costs of meeting your own recovery and recycling obligations. The initial subscription to Valpak in 1997 is based on your business's turnover but from 1998 onwards you will pay levies specific to the types of packaging materials that Valpak is required to recover or recycle on your behalf.

b) Provide Data

In addition to registration in 1997, obligated businesses are also required to submit a "reasonable estimate" of the packaging handled throughout 1996. This will include information on the weight and type of packaging/packaging materials that are supplied or exported by the producer and/or by a third party and including any imported packaging. From 1998 onwards, more detailed information is required and this will be used to calculate the weight, in tonnes, of packaging waste which you will be required to recover and recycle.

c) Calculate recovery and recycling obligations

In order to calculate how much waste you are required to recover each year, the following formula has been devised;

Recovery obligation (tonnes)	=	*tonnage of packaging handled in previous year (tonnes)*	x	*activity obligation (%)*	x	*UK recovery target (%)*

The activity obligation relates to the type of activity your business performs, ranging from packaging materials manufacture through to retailing. Each activity carries a specific percentage weighting. The two main activity obligations applicable to the fish industry will be packing/filling (36%) and retailing (47%). If a business carries out more than one of these activities it will have to calculate its obligations separately for each function. Imported

packaging is dealt with slightly differently in that all the preceding obligations, up to the point of import, are included and the transit packaging carries a 100% obligation. The recovery obligation initially applies to paper, plastics, aluminium, steel and glass, however, wood and other packaging materials will be included from 2000.

A similar formula is used for calculating your recycling obligation, however, this is material specific, i.e. the amount of each type of packaging material in the recycling obligation relates to the weights of each type of material handled by the business. The recycling obligation applies only to paper, plastics, aluminium, steel and glass. The UK recovery/recycling targets will differ from 1998 to 2000 in respect of the specific interim targets.

d) Meet the recovery and recycling obligations
Businesses which have chosen to comply with the Regulations on an individual basis will then be required to obtain supplies of packaging waste to meet their obligations. This need not be the particular packaging previously handled by a business and therefore a Local Authority or a waste disposal company can be contacted to assist in locating, recovering and recycling appropriate quantities of waste, from any source, on a business's behalf. Alternatively a business can subcontract to a company who will do all this on their behalf. At the end of the relevant year the business is required to forward a certificate of compliance to the appropriate Agency to state that they have met their recovery and recycling obligations. Non-compliance can result in prosecution.

A company which has joined a compliance scheme will not be responsible for meeting the specific recovery and recycling targets as the obligations pass to the compliance scheme. The business will, however, have to pay into the scheme the relevant sum of money.

How will this legislation affect the UK fish industry?

The cut off thresholds of 50 tonnes of packaging handled and £1 million turnover are likely to exclude large numbers of businesses in the fish industry. However, it is unknown and impossible to estimate how many will be either directly or indirectly affected.

Merchants, Wholesalers and Primary Fish Processors
Merchants, wholesalers and primary fish processors will be mostly concerned about the use of non-reusable fish boxes e.g. expanded polystyrene, although all the obligated packaging handled must be included. As an example, 50 tonnes of packaging is equivalent to a processor sending out 250 000 EPS boxes of 1 stone capacity, which would hold approximately 1600 tonnes of fish. Other types of boxes may be heavier but this tonnage of fish can be used as an approximation for estimating whether a business is obligated or not.

Problems for these businesses include collecting data from other sources. They will need to be aware of what their customers are doing with the packaging and how much waste is produced on-site. Wholesalers will also need to know whether the customers they are supplying to are obligated or not. The additional liabilities with imports, which these businesses may be heavily reliant on, are also likely to cause problems. Wholesalers will face additional obligations from

the year 2000 but should evaluate their current activites and packaging handled to establish whether or not they should register in 1997.

Secondary Fish Processors
Secondary Fish Processors face a complex system of data collection as they are likely to be handling different types, grades and materials of packaging for the different companies or names they pack for. Again they will have to be aware of what they and their customers are doing with the packaging, who owns the packaging, the approximate weights of all packaging items handled and all waste arising.

Fishmongers
It would appear highly unlikely that an independent fishmonger will handle 50 tonnes of packaging in a year. However a large chain of outlets should consider the possibility of being obligated. Multiple retailers, who have to consider all other items sold in stores, will inevitably be affected and face an enormous task in complying with this legislation.

Fish Friers
An independent fish frying outlet is unlikely to be affected by these Regulations. A typical outlet uses approximately 2 tonnes of paper each year and would thus find it difficult to handle 50 tonnes or more of packaging. A large chain of outlets should, however, consider the possibility of being obligated.

Some other general effects;
- It may be incredibly difficult to obtain reliable, consistent information from customers and suppliers. This information will be vital when trying to estimate the amount of packaging handled which is not counted towards the producer responsibility obligation.
- There may be increased customer pressure to use alternative materials such as lighter or more recyclable materials. This could possibly lead to changes in processing, distribution and handling systems. Businesses will have to be versatile in this and adapt to customer requirements to secure future or continued business.
- There will be additional time and administration costs. Businesses will have to consider who is going to be responsible for managing the data collection and overall compliance, and how they are going to do it.
- The additional obligations which imported packaging or packaged products carry may lead businesses to look for an alternative within the UK or a more cost effective means of transporting products into the country.

What should businesses be doing now?

To summarise, all businesses in 1997 should determine whether they meet with both of the threshold tests, and are therefore classed as obligated. This will involve all businesses undertaking some degree of data collection.

Obligated businesses should then:
- decide how to meet the requirements of the Regulations, by looking at the options available for registration and deciding what is best suited to the individual company,

- estimate the packaging handled in 1996,
- register with the appropriate Agency or compliance scheme and provide the estimate of the packaging handled in 1996,
- maintain records of packaging handled and functions performed in 1997.

It is envisaged after 2001 that a review of all systems throughout the EU will be undertaken and lead to tighter controls. It is therefore inevitable that targets will increase which may lead to many more businesses becoming affected. All businesses, whether currently obligated or not, should be aware of these Regulations and ensure they are kept informed of any further changes or new developments.

Useful organisations to contact:

Additional information on this legislation and full details of how to calculate your obligations are available from:-

- The Packaging Unit,
  Department of the Environment,
  Zone 6/F9, Ashdown House
  124 Victoria Street
  London
  SW1E 6DE
  Tel 0171 2698953
  Fax 0171 2698992
  A free environmental helpline is also available on 0800 585794.

For copies of the Registration pack (including a disk to help calculate the obligation)

- The Environment Agency (England and Wales only)
  The Producer Responsibility Unit
  Thames Region Environment Agency
  Hampton House
  20 Albert Embankment
  London
  SE1 7TJ

For general enquiries about the Regulations contact your local Environment Agency office or telephone 0645 333111:

- Scottish Environment Protection Agency (Scotland only)
  The Producer Responsibility Team
  Erskine Court
  The Castle Business Park
  Stirling
  FK9 4TR

East Region	0131 4497296
West Region	01355 574200
North Region	01349 862021

Compliance Schemes (not a complete listing)

- Valpak
  Macmillan House Business Centre
  96 Kensington High Street
  London
  W8 4SG

  0990 499799

  Wastepack
  c/o Keith Stark
  Pishiobury House, Pishiobury Drive
  Sawbridgeworth, Hertfordshire
  CM21 0AF

  01279 721721

Concluding Statement

K. Beeken - Grimsby Fish Merchants' Association

The findings of the work undertaken so far have proven to be very interesting, particularly in highlighting the different practices, with regards to waste, that exist between companies. It has been shown that, through relatively simple actions, there is money to be saved through waste minimisation. Such simple, low cost options for minimising waste will prove beneficial in the long-term. Certainly it will be foolish to ignore such measures, particularly in light of increasingly demanding legislation and rising costs. It cannot be emphasised enough that every single company will have to start to introduce measures to minimise waste if they are to remain profitable in the future.

The whole waste issue, including raw materials, water, effluent and packaging, is certainly not going to go away and we must all start to think carefully about how to address these problems if we wish to remain in a profitable industry.