WASTE STREAM – WASTE OILS

Summary

Historically, the waste oil sector has evolved as a number of businesses around which regulation has itself developed. Most waste oil streams (other than low flash materials) are managed under the Waste Management Licensing (WML) regime. From June 2005 the Regulator will be accepting waste oil sector Pollution Prevention and Control (PPC) applications. This is a significant step with both cost and cultural implications in moving from WML to PPC. The time and bureaucracy involved is expected to be high and currently there is little guidance on Best Available Technology (BAT) for this area.

However, the timing for PPC couldn't be worse. The full impact of the Waste Incineration Directive (WID) coincides with the waste oil sector PPC and with no clear policy set out for the regeneration issues that the Waste Oil Directive (WOD) raises for waste lubricating oils and WID guidance not yet made clear, the question arises as to why the industry should invest and if it wants to in what?

Many smaller firms are waste oil collectors feeding a network of larger collectors and processors thus ensuring a countrywide service. The concern is that the combined effect of PPC, WOD and WID may cause firms to exit thus in turn driving up the cost of replacement services. The UK has an excellent record of waste oil collection rates that is underpinned by historically robust markets for recovered fuel oils.

A number of Directives are combining in effect to dramatically change the user scenario (as an alternative source of energy) too. As a consequence the Hazardous Waste Forum elected to make Waste Oil a Priority waste stream. This paper sets out to understand the impacts of the changes, the waste streams that arise and what minimisation steps can be taken.

It concludes that the waste oil industry itself is not the vehicle to drive policy on the Waste Oil Directive and the implications of the Waste Incineration Directive will be faced and met by the recovered fuel user industries.

In effect, the waste oil industry is a broker with interests in the supply and output demand sides of the waste oil equation but is sandwiched between two large forces each with their own agendas.

The analysis shows that good waste oil disposal requires a number of technological solutions and a better balance has to be found between regeneration for lubricants and the combustion of much waste oil (i.e. recovery operations) with treatment for the remainder of the waste which are disposal routes.

In respect of waste minimisation, fuel waste is largely incidental (but nevertheless a fact) as most volumes are completely destroyed during combustion. Only the lubricants stream gives rise to forecast quantities requiring post use management.

This sector is in steady decline due to industry restructuring and more efficient usage in motor vehicles.

However, opportunities to use higher quality products with greater longevity do exist as new materials become available. Hence, waste minimisation will be largely driven by equipment manufacturers and lubricant designers. When fuel cell technology is adopted we can expect a dramatic drop in lubricant usage.

Integrated, this says that investment in the lubricants industry (and therefore waste oil) must be with great care as overall the low technology end of markets are shrinking as higher added value opportunities (and attendant lower volumes) increase.

No Government in the world has cracked the problem of waste oil management and left to their own devices neither have market forces. Policy options reside in Producer Responsibility and/ or Government intervention in the market.

1. BACKGROUND TO THE POLICIES AND MARKET CONDITIONS

Government Policies derived from:

- Waste Framework Directive 75/442 EC and the European Waste Catalogue
- PPC Directive 96/91 EC
- Environmental Liabilities Directive
- Groundwater Regulations and Water Framework Directive
- Waste Incineration Directive 200/76 EC
- Large Combustion Plant Directive 2001/80 EC
- Waste Oil Directive (WOD) 75/439/EEC modified by 87/101/CEE. *Article 3 of this Directive requires the UK Government to give priority to regeneration of waste oils, if technical, organisational and economic constraints allow*
- Structures of Tax and Excise Duties Directive 92/81 EC
- Landfill Directive 99/31EC

2. LIKELY FUTURE ARISINGS OF WASTE OILS CONSIDERING THE MARKET CONDITIONS AND PRODUCERS RESPONSE TO FORTHCOMING LEGISLATION

According to Environment Agency data waste oils and oil/water mixtures predominantly from vehicles, industrial machinery and ships, oil interceptors, tank bottoms and contaminated fuels account for 21 percent of consigned hazardous waste arising in England and Wales (typically some 1.2 million tonnes pa {tpa}).

However, waste oil data is notoriously suspect because of a lack of any widely accepted definition for waste oil including a lack of congruency in the Waste Oil Directive itself.

2.1 *What are the problems?*

Confusion initially begins with waste lubricants and fuels (mainly hydrocarbon) and those from the food industries (mainly animal or vegetable in origin). *This paper deals with waste lubricants and fuels*.

The broad categories of waste oil streams are:

(Mainly hydrocarbon)

1. Post use lubricating oils

2. Heavy Fuel Oil washings landed from the large trans-continental ships (typically containing 30% water) and from ferries and local traffic (typically containing 50% water)

Contaminated fuels (e.g. crossovers of diesel and petrol road fuels, off spec jet fuel), time expired military fuels *e.g. MOD, Customs and Excise returns etc.*

3. Fuel tank residues and sludges (often wet)

(Wastes with a higher water content but with some oil) →

4. Emulsions (e.g. from metal working or fire resistant hydraulic fluids)

5. Oil interceptors (e.g. from run off areas or storage/processing plant)

2.2 *Quantifying the waste arising and waste minimisation a sector approach*

2.2.1. Post use lubricating oil – Arising

Sales data for new lubricants is reliable (800,000 tpa in 2002) and from this it is estimated (using an empirical analysis tool) that about 50% is recoverable (**400,000 tpa). This represents the potential waste oil arising from this stream and falls under the Waste Oil Directive**.

Historical analysis shows the UK annually collects about 86% of this amount and by difference some 14% is unaccounted for. Incorrectly, this is often reported in official documents as 'dumped' or 'tipped'. While illegal disposal does occur, the Agency data shows not too much is actually recorded in absolute volume terms, but it is acknowledged a 'little goes a long way' as a pollution effect.

The fact of the matter is that not all waste lubricating oil is collected. Large industry e.g. steel works and power stations and some small outlets e.g. garages using space heaters, may internally dispose of their waste oil and there is no accepted method of its associated quantification.

2.2.1.1 Industry trends and waste lubricating oil minimisation issues

Lubricant sales are in slow decline (1-2% pa) particularly as large industry e.g. steel, coal, metalworking and manufacturing restructure. While the on road vehicle parc increases, lubricant sales do not increase in direct proportion as oil change intervals get longer, lower vehicle emissions dictate less oil consumption {and greater use of synthetic materials}, while fill for life components are even more widely deployed.

The Waste Oil Directive definition of oils is too general to be of much help, conflicts with that in other Directives and does not recognise the important role played today by synthetic materials. We can be sure however that these materials are collected, aggregated physically and included in the data.

As fuel cell technology is expected to increase over the next 10-25 years we can forecast that lubricant sales in volume terms will continue to decline.

Lubricants play an important but intrinsic environmental role in underpinning the efficient use of energy resources (by lowering friction), protecting machines and materials from wear and corrosion. The single largest influencer, in terms of waste oil arising, is that of the equipment manufacturers' when recommending and setting oil change periods. Lubricant costs are rarely more than a few per cent of the capital or operating costs of a machine while users are invariably risk adverse. Hence, few will ignore a manufacturer's advice to change/replace a lubricant but that is not to say that oil change periods won't gradually increase. With new synthetic lubricants we can expect longer drain intervals and an increased use of machine condition monitoring techniques in industry will also enhance fluid life by better predicting when to change oil.

However, opportunities to use higher quality products with greater longevity do exist as new materials become available. Hence, waste minimisation will be largely driven by equipment manufacturers and lubricant designers. When fuel cell technology is adopted we can expect a dramatic drop in lubricant usage.

Integrated, this says that investment in the lubricants industry (and therefore waste oil) must be with great care as overall the low technology end of markets are shrinking as higher added value opportunities (and attendant lower volumes) increase.

Suggestions to minimise waste lubricant arising include:

1. Increasing the awareness of the manufacturing (particularly the automotive) industry of the issues and impact of (hazardous) waste oil creation through an extension of ELV Directive policy?

2. Through Trade Associations and with the DTI, Envirowise etc., encourage the lubricant chemical performance additive package manufacturers that they need to choose materials (with a less hazardous rating) that will impact less on the environment when they become waste. (These packages now often comprise some 20% by weight of a lubricant and can be a barrier to recycling).

3. Encouraging the Regulator to show flexibility on processes and schemes designed to recover and re-use lubricants rather than rigidly apply waste regulations that stymie pragmatism. This is a simple logic – if it doesn't need to be classed as waste and the environment is not a at risk why do it?

2.2.2 Heavy Fuel Oil washings landed from large ships

It is estimated that this sector, which is a function of trade, gives rise to 150,000 + tpa of waste fuel oil that on reduction of water content creates around 100,000tpa of Recovered Fuel Oil **(**RFO).

This volume, being derived from a fuel, is **not** a direct function of the Waste Oil Directive (WOD) though it is commonly believed that it is. There is however a connection with the WOD in that ships fuel is mostly of high sulphur content (typically (1.0 - 3.5 % range, - averaging in 2003 some 2% sulphur). RFO users cannot exceed 1.0% sulphur in their authorisations so waste lubricant feeds (typically 0.7% sulphur) are blended with the ships fuel to meet such requirements.

2.2.2.1 Industry sector trends / ships waste fuel oil minimisation issues

The associated volumes are a function of world trade and while ships are getting larger and more fuel efficient the quality of the heavy residual fuel they use is both poor and variable. As a pollution control measure the EC plans to further reduce fuel sulphur contents but it is believed that the need for greater on board ship fuel pre-treatment will increase and hence waste volumes will grow.

There is little obvious, policy wise that can be done to minimise the international residual fuels usage situation since 'cleaner' alternative fuels (distillates or gas oils) are significantly more costly.

2.2.3. Contaminated fuels (e.g. includes crossover deliveries of diesel and petrol road fuels, off specification jet fuel), time expired military fuels (e.g. MOD), Customs and Excise returns) etc.

This sector is nigh impossible to quantify since circumstances depend on too many and unpredictable variables (e.g. accidents) and few originally plan to have to dispose of expensive fuels. It is thought the disposal quantities rarely exceed 50,000 tpa.

Note: Low flash point materials (e.g. petrol) are mostly managed by the solvents industry recovery trade (need for specialised handling) as opposed to oil recyclers.

2.2.3.1 Industry sector trends and waste minimisation issues

Disposal or recovery options in the above sector depend largely on the economics and given the position described there are no obvious policy choices.

The key point is that there appears no shortage of disposal capacity.

2.*2.4 Remaining classes of waste oils and sludges*

(Need input of Treatment Group here /difficulties with interpreting Babtie data?)

1. Fuel tank residues and sludge's (often wet)

Wastes with higher water content but with some oil) →

2. Emulsions (e.g. from metal working or fire resistant hydraulic fluids)

3. Oil interceptors (e.g. from run off areas or storage/processing plant)

These classes are the most difficult to review both in terms of their nature (which is often indefinite being oil/water/suspended solids) and their overall volume quantification.

A general rule is that where free oil can be decanted it is so and aggregated with other waste oils for fuel use. Certain specialist companies attempt to split emulsions, thus gaining further free oil, leaving a partially oil and chemicals contaminated water phase (which can then be treated before discharge) and some solid /sludge. Historically, treatment was tailored to circumstances with residues being solidified by mixing with other (dry) waste and land-filled.

2.2.4.1 Industry sector trends and waste minimisation issues

It is believed that oil interceptors and associated oily waters are the largest contributing volumes in this sector. PPC implementation and the use of Best Available Technology (BAT) on site across industries will increase the amounts requiring treatment with landfill restrictions obviating most historic disposal options.

It is a moot point as to whether industry under PPC itself want to invest in on site equipment to minimise off site disposal costs, but the potential for physically concentrating oily contaminated waste water streams is very high through chemical/physical and/or biological treatments.

2.2.5 Summarising the waste arising and waste minimisation options

Summing the relatively well identified waste oil sectors gives (tpa): 400,000 waste lubricants, 100,000 ships fuels, 50,000 other fuel, in total 550,000 mostly hydrocarbon. Existing Environment Agency data suggests a total of 1,200,000 tpa in the whole class, which by difference, suggests 650,000 tpa is mostly oily water and sludge.

At first glance this appears somewhat distorted (*what do the waste treaters say?*) though it is anecdotally known that the amounts of oily water arising are very high.

Only the waste lubricating oil sector shows a downwards trend in waste arising and here the usage of lubricants is a planned choice and any policy options can be targeted. In other sectors the waste arises incidentally from either a main use of fuels or by their associated handling/storage e.g. spillage and losses at garage forecourts.

The impact of a command type policy e.g. The Oil Storage Regulations, has yet to be measured, but this must improve the chances of better containment and therefore less spillage/loss giving rise to associated lower levels of waste.

2.3 WASTE OIL RECOVERY /DISPOSAL

2.3.1 Existing Practice

It is concluded that currently there is no shortage of waste oil collection systems, operators, simple processing capacity for producing Recovered Fuel Oil (RFO) from either waste lubricating oil, ships fuel or other mid distillate petroleum streams.

Similarly, it is believed there is no current shortage of capacity for processing oily water or sludge but at a cost to the waste generator.

Other low flash hydrocarbon based fuels can be absorbed into Secondary Liquid Fuels (SLF) processes for cement works or incinerators but at a cost to the waste generator.

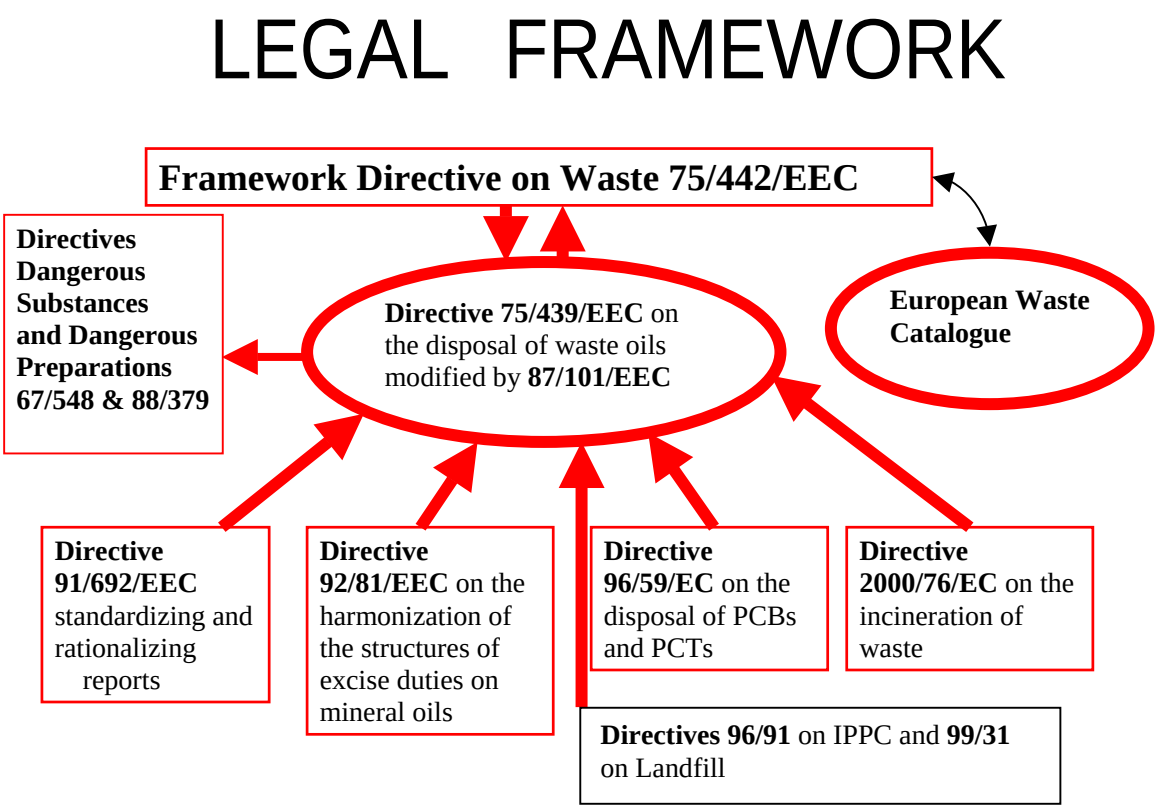
Economic conditions have been good in that robust markets exist for RFO and SLF. Since most waste oil capable of combustion goes to RFO usage, it is remarkable that the waste can be sold at a discounted, but positive price, compared to virgin fuel oil. This is in no small amount due to a fierce competition for supplies from both the coal fired power generation and road stone dryer sectors and the need to contain collection and processing costs. The demand from these users (~500,000tpa) was such that used oil from Norway, the Netherlands and elsewhere was being imported to the UK.

The demand profile and assistance of duty derogation are the biggest reasons why the collection rate of UK waste oil (86%) is so high.

2.3.2 Future Practice

2.3.2.1 Regulatory Overview

The number of Directives impacting on Waste Oil management is particularly high and often appear to conflict with one another. This paper has attempted to highlight the major issues but is by no means exhaustive in its analysis. It is therefore important to focus particularly on the lubricants business with the Waste Oil Directive but recognise not all waste oil is lubricant derived. The interaction between the key Directives is demonstrated below:



In order to better understand the dynamics of the regulatory framework each key Directive is overviewed below:

2.3.2.2 Regulatory Impact

(i) Impact of the Waste Oil Directive (WOD)

Government is required to give a higher priority to regeneration (re-refining to basic lubricating oils). Currently, there is no UK regeneration operation in use with the major oil players believing the WOD is obsolete, ineffective and unlikely to produce acceptable outputs at economic cost. There is also no market ambition signalling its willingness to absorb recycled materials.

Notwithstanding that position, the WOD aims to underpin sustainability. Hence, the UK government has commissioned a study (Oakdene Hollins) designed to explore initiatives and options that could drive regeneration ideals. The study does not recommend the emulation of practices deployed in Italy or Germany (the major areas of European regeneration) as simply they are seen as not working, at least without high cost and excessive bureaucracy.

Government has been advised to consider a hazardous waste oil permit trading scheme rather than directly subsidise regeneration. However, it will need to consider the Australian Product Stewardship experience because it is necessary to regulate the waste oil streams that invariably give rise to fuel options as well - hence a scheme of output product differentiation is probably required.

(ii) Impact of the Waste Incineration Directive (WID)

This has the potential to shut out the key existing user markets for RFO from the end of 2005 (power generators and road stone dryers). However, the cement industry would be able to comply with WID so combustion can continue (an oft overlooked point) but as it has a wide choice of waste derived fuels, then it could demand a gate fee (a negative value) for RFO. The implication is to pass collection costs back to the generator which seems a simple enough solution. However, waste lubricants are ubiquitous by nature and the concern is that a myriad of generators will ‘lose oil’ rather than pay for its collection thus impairing the UK’s sound collection record (86%) while increasing pollution.

Co-combustion of RFO does remain an option for coal fired power generators (a 50% market user) and has a number of advantages:

1. Very large volumes of waste oils are likely to require combustion where they are unsuitable for regeneration or the scale of regeneration available is too small.

2. Usage underpins energy recovery (R activity)

3. It displaces coal fuel and is less polluting

4. It creates positive value thus maintaining collection at low cost – an incentive for waste generators to safely dispose

5. In the supply chain waste collections can be made relatively impromptu rather than waiting for high value invoices to be first settled by waste generators. This avoids stockpiling of waste.

RFO usage is only about 1% of the costs of power station fuel costs but requires investment to initialise its use and costly applications for authorisation. Power generators therefore require clear policy signals from Government.

Post 2005, combustion of RFO appears to be a less likely option for road stone burners (a 50% market user) because burner operating conditions, although very close to being compliant, cannot be easily guaranteed to meet WID.

However, this will be case specific and should not be ruled out.

The road stone industry finds it odd that Government may exclude from the WID small space heater operations burning on site waste oils with only minor licensing conditions attached. While individual operations are small (2-3 t/day) the potential is for many thousands of users.

Some observers suggest that WID will have the effect of driving collection costs back up the line to waste generators and therefore benefit regeneration because it will lower the gate fee for waste oil at a (regeneration) plant.

Sceptics respond by pointing out that the market will not accept regeneration without a ‘heavy’ intervention from Government and therefore it is unlikely there will be more than a ‘light’ UK investment in new plant. However, there is nothing in the Trans Frontier Shipment of Wastes Legislation to preclude exporting UK waste oil for recovery purposes.

(iii) Impact of the Large Combustion Plant Directive (LPCD)

The future of coal fired power stations is dependent on policy made under this Directive. Here it is sufficient to say if ultimately there are few or no coal stations, then the associated market for RFO will not exist.

(iv) Duty Derogation

It is mooted that the duty derogation currently applied to combusted RFO will end in 2006. Effectively, this will reduce the financial support to the RFO trade by 3.8ppl (at current rates this is ~ £42/t). This will have to be recovered from the waste generators (the selling price of RFO is currently about £70/t and the duty could not be absorbed). The concern is that mentioned under WID above, i.e. generators will ‘lose oil’ rather than pay for its collection. It also poses numerous problems for the duty

collection process for few waste oil facilities are either bonded or in a position to meet exacting customs conditions while the cost of doing so is likely to be high.

(v) Landfill Directive – impact on non recoverable (i.e. Disposal) waste oil streams

It is concluded that historically there has been no shortage of waste oil collection systems, operators or, processing capacity for disposing of oily sludge or oily water.

The imposition of the Landfill Directive alters that position because of a ban on liquids or mixing wastes to form a dry waste e.g. an absorbent process.

(Need input of Treatment Group) Use of Babtie report?

(vi) European Waste Catalogue (EWC)

The EWC impacts on a number of Directives and associated regulations affecting waste oil streams. However, its use is going to be problematic because the EWC categorises waste streams by an odd logic of application and chemistry but not in a consistent manner. It comes about because it was developed from a sale of new products classification philosophy, but not how waste is actually managed.

All waste oil is classified as hazardous despite the fact that in respect of lubricants its virgin precursors are mostly not. Hence, a very large volume of waste oil has been drawn into the hazardous regime for no rational purpose.

Waste oil generators rarely know, in any detailed context, what their waste oil stream comprises of because it is usually an aggregation of oils e.g. engine oils are mixed at garages with gear oils and automatic transmission oils are actually hydraulic fluids. What code then to use? Oil Banks at local authority sites can contain virtually any liquid waste stream and the waste collector is simply called in to remove it. He can have no control on the contents whatsoever.

This problem can be aided by classifying waste oil streams as:

1. Suitable for regeneration (i.e. known sourcing)
2. Suitable for combustion only (mixed fuels /unknown lubricants/limited chlorine content)
3. Suitable for incineration (e.g. PCB contamination/high chlorine)
4. Emulsions/oily water (can be combusted or treated)
5. Dried sludge for landfill

(vi) PPC Directive

Historically, the waste oil sector has evolved as a number of businesses around which regulation has itself developed. Most waste oil streams (other than low flash materials) are managed under the Waste Management Licensing (WML) regime. From June 2005 the Regulator will be accepting waste oil sector PPC applications. This is a significant step with both cost and cultural implications in moving from WML to PPC. The time and bureaucracy involved is expected to be high and currently

there is little guidance on Best Available Technology (BAT) for this area. *The Regulator has initiated joint industry /Environment Agency working groups to address that issue.*

However, the timing for PPC couldn't be worse. The full impact of WID coincides with the waste oil sector PPC and with no clear policy set out for WOD and WID guidance not yet made clear, the question arises as to why the industry should invest? Many smaller firms are waste oil collectors feeding a network of larger collectors and processors thus ensuring a countrywide service. The concern is that the process of moving to PPC may cause firms to exit local markets thus in turn driving up the cost of replacement services.

3. POLICY RESPONSE

Policy Response

Currently policy on waste oil is targeted through a number of Regulations at the waste oil industry itself rather than original oil product manufacturers or waste generators. The waste oil industry therefore naturally provides a response that is led by market forces and the commercial outlets for its processed waste streams or disposal services provided. This may and does conflict with a major part of the Waste Oil Directive i.e. its regeneration priority.

The waste oil industry is clearly not in a position to greatly influence the original lubricants manufacturers that waste oil regeneration is desirable nor their lubricants customers that using recycled oils is in their interest.

On the other hand waste oil generators have little interest in the destiny of their outputs other than minimising cost and remaining legal.

Intellectual debate has questioned the value of the Waste Oil Directive which needs reviewing in the light of twenty seven years of EC experience and its apparent failure to meet its original objectives. Nevertheless, meeting the WOD remains a central legal obligation and it seems that as market forces have failed to achieve that then either a Government intervention or some form of Product Stewardship legislation (as in Australia) may be required if it is to be delivered.

Policy Deliverables

The task for Government is to implement *especially* the Waste Oil Directive in respect of developing an incentive for regeneration of waste oils. Independent consultation has been taken by Government in this respect which rejects the concept of major market intervention or subsidies. Therefore the mechanics of a trading scheme need developing.

From an understanding of what Government intends, both the oil and waste industries will then need to judge whether or not to invest in UK based regeneration or to consider exporting the recoverable element of waste oil to other areas.

Guidance on the Waste Incineration Directive needs clarification with policy recognising that combustion versus regeneration is not a game of alternatives but that they are mutually necessary activities. Driving waste oil combustion via a WID policy to just one industry is both limiting and fraught with danger. Indeed the Cement Industry has signalled that it has capacity limitations.

Policy on waste and product issues needs clarification and support if the recycling industry is not to suffer a catastrophic loss of confidence and a lack of investment in its future. This should be the policy target of Government in pushing the Commission to revise the Waste Framework Directive 75/442. Linked to this is the issue of definitions in both the WOD and EWC.

The largest danger is that the UK sacrifices the ideal of having an excellent waste oil collection record, nationwide cost effective coverage, user outlets that are duly authorised recovering a high proportion of energy and all this while saving new resources which are relatively low polluting.

4. KEY DECISIONS AND TARGETS (To be completed)

Targets should be considered for the reduction of oil wastes.

Consideration should be given on whether the targets should be made statutory or voluntary and include timescales.

- **Producers**

- **Waste Industry**

- **Regulators**

- **Government**

(Input co-ordinated by the Oil Recycling Association)