

# CONSORTIUM TACKLE WATER MIX METAL WORKING FLUID DISPOSAL

*The dual approach of novel formulatory techniques and advanced waste separation processes is currently under development in a 2 year project to address the environmental, ecological and technical issues of the disposal of water mix metal working fluids (MWFs). Tony Lesowiec of the project co-ordinator, Pera, reports.*

Manufacturers of MWFs are often rightly focussed on formulating products to meet the ever-increasing demands of machining processes imposed by the end user engineering sector. The cost of additives and base oils also play a part in the final fluid make up. But how many formulators consider the disposal of the fluid as a primary consideration?

With tightening environmental legislation and rising disposal costs, the waste treatment of spent fluids is becoming increasingly important. One only has to take a look at the current situation in Germany where end users are under pressure to clean up their act by recycling their wastes on site or face expensive disposal costs. The principle of polluter pays is the name of the game. The following strategy advocated by European legislative bodies is becoming increasingly evident.

- First priority - Prevention/reduction of waste at source.
- Second priority - Promotion of recycling recovered materials at end user sites.
- Next - Promotion of recycling waste materials as a secondary fuel energy source. Last resort - disposal to environment.

In order to provide some scale of the waste disposal problem in Western Europe, the UK, which is in the top five users of water mix MWFs in the region, produces around 20,000 tonnes of product per annum. If the most commonly used fluid preparation level is applied to this figure i.e. five parts MWF to 95 parts water, on a simplified level this equates to 400,000 tonnes of waste fluid per annum.

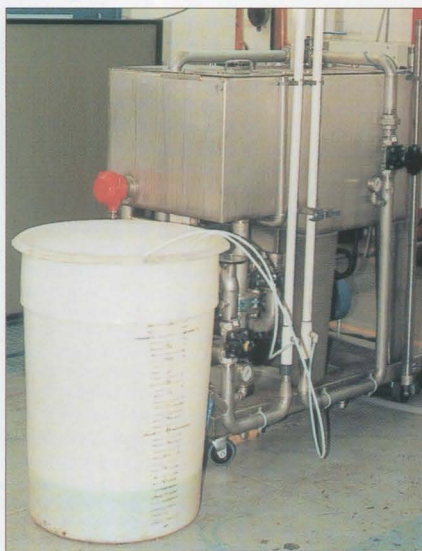
## DISPOSAL

Traditional waste treatment methodologies such as ultrafiltration and chemical separation are limited in their capabilities as stand

alone technologies, and almost completely ineffective for the fully synthetic fluids where there is no emulsified oil to separate. Evaporation technology however, which is commonly used by our European partners is largely capable of treating these fluids. Biotechnology is a promising alternative treatment option for spent fluids, unlike the others it is based on destruction of the pollutants rather than separation and concentration. Its biggest drawback is its slow treatment rate. The key to optimising this technology is to identify an effective method to neutralise the toxicity in the fluids.

The recovered water from these primary treatment processes is usually suitable for sewer disposal and this is policed by the Environment Agency. One of the main cost influencing factors for sewer discharge (based on the Mogden formula) is the chemical oxygen demand (COD). It is therefore important to target COD reduction in any treatment systems. This means providing effective technology for dealing with the dissolved organic components such as corrosion inhibitors, coupling agents, biocides and dyes. Other parameters that need targeting are the oils and grease levels in the water phase and of course the total volume of waste. One of the primary aims of the Pera project is to polish further this recovered water to a suitable quality to enable reuse on site e.g. for preparing new fluid mixtures, for washings or cooling etc. thereby preventing/reducing sewer discharge. This has the double benefit of reduced disposal costs and saving purchasing fresh mains water. If ultimately the water is sewer discharged it would cost less to do so because of the reduction to COD.

One must not lose sight of the disposal of by-products from any treatment system. Both an oil phase and solid phase are also likely to be produced. The solid phase may consist of dirt, grit, sludge, particulates or flocculants and these are usually disposed of to landfill. This is becoming increasingly unattractive due to rising costs and tightening legislation. In some cases the recovered solid phase is incinerated although this is more expensive than landfill. The recovered oil phase can contain a high percentage of water and other contaminants. This phase is normally collected by waste treatment companies for low level processing involving dehydration and filtration to produce a burner fuel product or is used without processing as a support fuel in kilns in the cement manufacturing industry.



Two primary treatment options, ultrafiltrators and bioremediation.

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## COMPONENT LEGISLATIVE SPOTLIGHT

Alongside the cost implications of disposal, certain components of the fluids have also come under the legislative spotlight. Committees such as the Oslo and Paris Commission (OSPARCOM) have been created to control the chemical components that might, from a waste disposal view-point, have an effect ultimately on marine life. It has become increasingly important therefore for suppliers of these fluids to be conscious not only of the in-use performance of the water-mix MWFs, but also how the component used may ultimately affect the disposal characteristics of the products. Similarly, from the user standpoint it has been necessary to consider more exacting and cost effective disposal methods to reduce the commercial demands produced by the current and potential legislation.

As a result of these industrial concerns, a two year project was set up under the framework of the European Commission Craft Programme with a consortium of eight partners providing complementary technical expertise and end user experience. These European based partners consist of additive supplier Polartech Ltd; fluid formulators Fimitol GmbH, Zorelor SA, Brugarolas SA and JP Industrie; and waste treatment technology providers EnviroBac Ltd, Lanstar Ltd and Koch Membrane Systems. The aim of the project is to (i) develop MWFs for low or reduced cost disposal based upon current and potential legislative disposal requirements of the European Union and (ii) develop a cost effective waste treatment system for these products.

This is being approached by two main routes, utilising the expertise of the fluid formulators and the disposal technology providers.

- Development of novel water mix MWFs which are free from components likely to be unacceptable from either a disposal or health and safety standpoint. The selection of components that have been identified as contributing to lower COD and toxicity of the fluid and thus have enhanced treatment capabilities on fluid disposal.
- Evaluation of innovative and current disposal methods for water mix MWFs with the view to optimising and integrating those best performing technologies to provide a new cost effective route.

Innovative work has been carried out with respect to formulatory concepts of the fluids at both laboratory and pilot scale and a number of novel formulations have been devised. These have

subsequently been evaluated at end user sites to determine their suitability for use prior to being considered from disposal viewpoint.

In tandem, extensive evaluation of the disposal technologies has been completed at the Pera research facility and this has led to the development and design of a prototype hybrid system which could be adaptable across a wide range of user requirements.

## SPECIFIC BENEFITS

As the project nears completion, the combination of new fluid products and novel disposal treatments will be utilised at workshop sites to confirm the economic and environmental benefits of the study which are expected to arise from:

- Development of MWFs capable of meeting current and future legislative regulations throughout Europe with respect to disposal and health and safety requirements.
- Reduction in end user disposal costs by improving the quality of waste and recycling the recovered water phase on site and so reducing the volume of waste.
- Greater flexibility in managing waste costs as a result of maximising product life and minimising and controlling exact disposal outputs.

It is expected that all consortium members will be able to gain significantly from the results of the programme and chairman of the Exploitation Committee, Mr Robert Stubbs of Polartech Ltd is particularly pleased with the progress.

"It has been very refreshing to see the frank and open exchange of views between the members of the consortium in an industry that has been traditionally very secretive about its own in-house technology. This has resulted in a very high level of cross fertilisation of ideas between the fluid formulators and the disposal experts providing some interesting and novel conclusions to the projects goals."

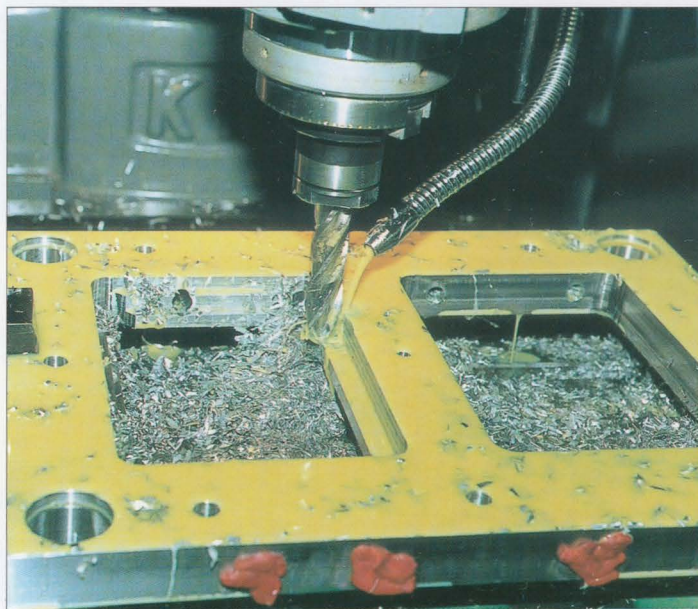
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Today's fluid formulators have been greatly advanced by the development of novel additive packages .





# LUBETECH

## CHANGES IN THE APPROVAL SYSTEM FOR FOOD INDUSTRY LUBRICANTS USDA DIVISION IS CLOSING DOWN

The system which for many years has been universally accepted as the basis for evaluating lubricants as being suitable for use in the food industry is that of the U.S. Department of Agriculture (USDA). Their Food Safety and Inspection Service 'Guidelines for Obtaining Authorisation of Compounds to Be Used in Meat and Poultry Plants' details the requirements placed on suppliers of such products. The USDA list of approved products is also recognised by the US department of Commerce and the National Marine Fisheries Service.

A list of food-grade products, published on an annual basis by USDA, includes some 115,000 compounds and substances including cleaning compounds, laundry compounds, sanitisers, pesticides, hand care products, potable water treatment chemicals, boiler water treatment chemicals, and lubricants in addition to many other categories of compounds.

However, notice has now been served that this system is to be discontinued according to a recent statement from USDA announcing their intention to close the division charged with evaluating the formulations of food-grade products.

In the US, two Federal laws require the maintenance of safe and sanitary conditions in federally inspected meat and poultry plants. These two laws are the Federal Meat Inspection Act as amended by the Wholesome Meat Act of 1967 and the Poultry Products Inspection Act as amended by the Wholesome Poultry Products Act of 1968. These Acts are enforced by the Food Safety and Quality Service through the Meat and Poultry Inspection Program (MPI).

The Inspection Program calls for authorisation of the use of substances and compounds in the plants, because misuse of such material may result in adulteration or unwholesomeness of meat and poultry being processed. Food Ingredient Assessment Division, Science evaluates compounds proposed for use in plants and authorises, where appropriate, the use of safe compounds.

The scope of the compound evaluation program is national and international in significance. All chemicals produced anywhere within the United States for marketing to federally inspected meat and poultry plants must be evaluated by USDA. In addition, chemicals produced outside of the United States for marketing to U.S. plants or to plants exporting meat or poultry products to the United States may require such evaluation. Though USDA deals mainly with firms supplying chemicals to federally inspected meat and poultry plants, their primary responsibility is to the Federal inspectors in those plants. In that respect, their primary consideration is to provide inspectors with continual assurance that chemicals used in federally inspected plants are authorised for use and that their proper use will not result in the adulteration or contamination of food products.

Section 5.15 of the 'Guidelines for Obtaining Authorisation of Compounds to Be Used in Meat and Poultry Plants' deals specifically with Lubricants and is divided into two parts:

(A) Preparations consisting of one or more of the listed

materials or those generally recognised as safe (CFR, Title 21, Part 182) are permitted for use as lubricants and anti-rust agents, or as release agents on gaskets or seals of tank closures, where there is a possibility of incidental food contact. The amount used should be the minimum required to accomplish the required technical effect on the equipment so treated. [Also see Section 6.4 (D)]

(B) There is no specific list of substances which may be used in lubricants where there is no possibility of food contact (H2 classification). Most substances generally used for the purpose in industry would be acceptable. Substances which are categorically unacceptable for such use are listed among the substances in Part 7 of the Guide. However, USDA also states that there may be other substances which are not acceptable because of unfavourable toxicology or other considerations. Each preparation would therefore be evaluated on its own merit.

In order to gain approvals, the supplier was required to provide evidence to the Inspection Service in the form of suitably completed application forms, samples, copies of product labelling and supporting evidence. Such evidence would have included the gaining of a Food and Drug Administration (FDA) clearance on all ingredients, which would have already required the supplier of the ingredients to have submitted extensive details on the ingredients to the FDA, including toxicological test results. A fee is charged by the FDA for providing this service, the extent of the charges being dependent upon the amount of work undertaken by the FDA. (Note: The FDA is to continue to provide this service in contrast to the USDA intention to withdraw). If all is satisfactory, products will then receive approvals to either H1 (incidental food contact) or H2 (no contact). No charges are involved in gaining such recognition. Suppliers are then entitled to incorporate the phrase 'Authorised by USDA for use in federally inspected meat and poultry plants' in a discreet manner on the label. The use of the phrase 'USDA Approved' is not allowed since it may connote an endorsement of the product by USDA. The scope of the categorisation is limited to products used in machinery associated with meat, poultry, fish processing plants and therefore does not include e.g. beverages, confectioneries, etc., although in practice lubricants to USDA specification are habitually specified and used in all areas associated with food.

However, as mentioned earlier, this system, which has operated satisfactorily for many years and is recognised world-wide, is about to end. Although the reason given by the USDA was the requirement to move from a stifling prescriptive command and control system to one which provides greater flexibility and responsibility to the industry to produce safe products for customers, many suppliers have a different viewpoint. If individual suppliers and users need to perform their own research and evaluation in future, costs to the private sector will inevitably increase, and there is also a possibility of the customer being put at risk if this independent system of arbitration is lost. It is also understood

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that the USDA do not intend publishing a final list of approved products. The situation has already caused widespread concern in the U.S.; those suppliers who are in the process of developing new products suitable for use in the food industry rightly claiming that they will now suffer a competitive disadvantage against established products as a result of no longer being able to claim USDA approvals, which contravenes the strict U.S. laws on competitive issues. This in turn could lead to suppliers of established products seeking higher prices, and could also stifle the development of newer products which may well be superior in terms of performance and in health and safety terms. Also, smaller companies could be unfairly disadvantaged if the costs of entry into the market are increased.

As a result, there has been some degree of activity to endeavour to establish a new body. One of the prime movers

has been ELGI, the European Lubricating Grease Institute. Greases are one of the major classes of compound which are often associated with incidental contact food machinery lubricants, and ELGI are currently evaluating the degree of support for establishing a replacement approval system.

Any individual or organisation wishing to become involved, or add general support, to setting up a new body is requested to contact the ELGI Secretariat, i.e.

Carol Koopman,  
European Lubricating Grease Institute,  
Hemonylaan 26, 1074 BJ Amsterdam, The Netherlands,

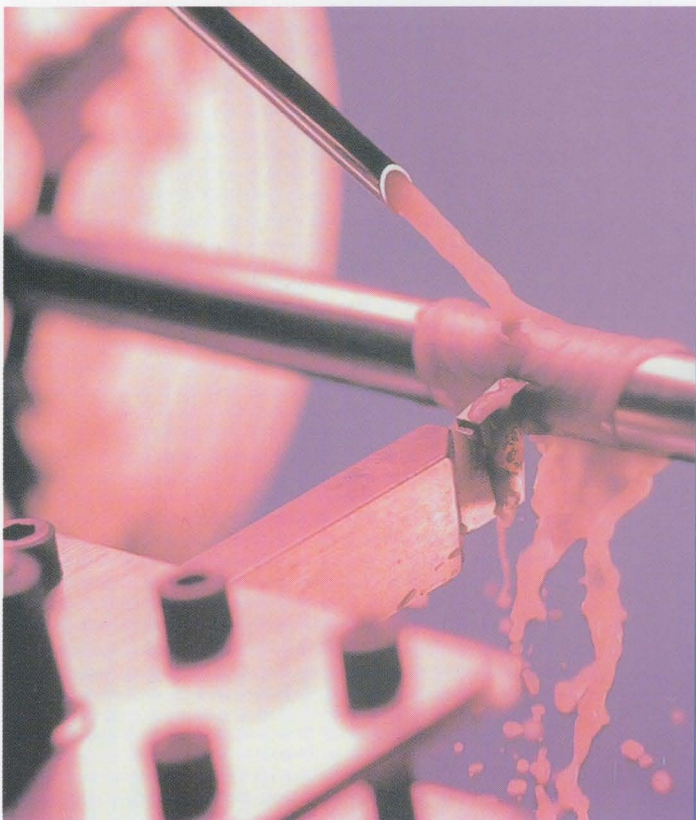
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**David Margaroni**

## New base fluids technology from ICI company for high performance, low environmental impact metalworking fluids UNICHEMA PRIOLUBE SELF EMULSIFYING ESTERS

A range of advanced base fluids for metalworking lubricants has been developed that offer major benefits: these include extended fluid working life; greatly reduced consumption levels; the minimisation of the effects on fluids of water hardness and cheaper disposal and recycling costs. The significantly lower levels of usage also reduce environmental impact.



Unichema, a member of the ICI group, under the company's PRIOLUBE brand, is marketing this range of self-emulsifying esters (often called SEEs). Advanced multifunctionality is achieved as these esters are based upon a single compound that combines lubricity and emulsifying functions. Therefore the benefit of these advanced Priolube products is that the emulsifier and the base oil can never be separated.

Unichema has carried out a comparative field test of the self-emulsifying ester based metal working fluids. Over a two year period, the end user engineers have consistently found that they did not need to change the SEE fluids, whereas the commercial counterpart (mineral oil based) had to be emptied and renewed five times.

A problem with conventional metal working fluids is the formation of calcium soap deposits, which can be particularly troublesome in 'hard water' areas with high calcium levels. Self-emulsifying esters remove this problem as they are stable in hard water and do not foam in soft water, thus creating savings for blenders and users.

### **Formulation and usage software to support new SEEs**

Unichema has also developed tailored software to help blenders and formulators to calculate end users cost savings when using the self-emulsifying esters. In particular, this software gives a direct comparison between performance of the SEE based and conventional metal working fluids. Called SEEmulator, the program allows the calculation of key fluid management factors. These include the expected disposal volumes; concentrate consumption; total metalworking fluid system costs; relative cost savings of the SEE formulations; margin benefit to the blender and end user - all on an annual basis. The software is particularly appropriate where end users are using Total Fluid Management, as the software will also calculate the commercial benefits both to the fluids seller and buyer.

### **Formulation meets wide user needs**

The new product range consists of four emulsifying base fluids to meet a variety of metalworking applications from precision engineering through to aluminium and steel rolling mills: 3951 (transparent), 3952 (milky), 3953 (coarse milky) and 3955 (translucent). Unichema supports the market with worldwide technical service; these base fluids are available to blenders and distributors.