



MWF - PRODUCT STEWARDSHIP AT MACH 2002



AN INITIATIVE OF THE BRITISH LUBRICANTS FEDERATION.

Concerns about health, safety and environmental (HSE) aspects of metalworking fluids (MWF) are not new. In several countries, including USA, Germany and Scandinavia, there is a more pro-active role about these aspects compared to the UK.

For this reason the BLF MWF Technology Group has taken a highly proactive approach to introduce Product Stewardship.

This article introduces the British Lubricants Federation Metalworking Fluid Stewardship Group (PSG), some of the issues being discussed within the group, as well as those being addressed by individual members.

INTRODUCTION.

The main purposes of metalworking fluids is to reduce friction at the contact points between tool and workpiece and between tool and chip, i.e. to lubricate, and to remove the deformation heat and friction heat arising during cutting, i.e. to cool. They also have the additional job of flushing away the chips and prevent dusting.

At the same time they should provide in-process corrosion control and not foam or leave sticky residues.

In addition, they should not increase the risks of skin irritation, have a long life, low misting properties and last, but not least, should be easily disposed of via a licenced waste oil collector.

There are two main groups of metalworking fluids: 1) neat oils, which are non-water miscible and used directly, i.e. undiluted and 2) water miscible fluids, which are diluted with water before use.

Neat oils are based upon mineral oils, synthetic oils or vegetable oils and may contain, in addition, other additives including extreme pressure agents, wetting agents, anti-misting agents, etc., as other ingredients.

Water miscible fluids may or may not contain: mineral oil, extreme pressure additives, corrosion inhibitors, emulsifiers, lubricity agents, and biocides.

During recent years many of the modifications to MWF's incorporated by MWF manufacturers have been driven by HSE concerns. Examples include elimination or minimization the HSE effects by prohibiting short chain chlorinated paraffin's, nitrosamine-forming agents and triazine type of

biocides. It is believed that in the UK the absence of legislation to outlaw specific components allowed some marketers to continue with outdated formulations, which fail to represent best practice. At the same time the amount of new HSE information about chemicals is increasing rapidly, hence an industry-wide approach to these issues is beneficial. The result of this is the introduction of the British Lubricants Federation Metalworking Fluid Stewardship Group.

PRODUCT STEWARDSHIP

There are already several schemes available for individual companies to implement environmental issues within management systems. Examples include the Responsible Care Program and ISO 14001 certification. Product stewardship is linked to these on a product level. Product stewardship aims to limit adverse HSE aspects during the full life cycle of the product, i.e. from raw materials, production, use and recycling to final disposal.

Members, who have signed a Code of Ethics promising to fulfil the Stewardship Principles, are metalworking fluid suppliers and raw material suppliers. Government agencies and an independent consultant are the associate partners.

Although the Product Stewardship Group as set up by the BLF has only existed about one year, it is unique as it includes HMG Agencies who regulate the metalworking industry and it will put the UK in the forefront of HSE issues.

RAW MATERIALS

In Europe HSE legislation is largely based on European Union (EU) ruling. It falls beyond the scope of this article to go into detail of this ruling, but it plays an important role in the selection of metalworking fluid ingredients.

It is estimated that out of the 100,000 known chemicals, 30,000 are commercially available. The EU issues lists describing how several hundreds of these 30,000 chemicals must be labelled. Examples of these labels include: Flammable, Toxic, Irritant, and Dangerous for the Environment.

Once a change in labelling is known, users may wish to look for alternative chemicals with less severe labelling. Also, the use of certain chemicals may be restricted by government based on the labelling of these chemicals. Below table lists some well-known (old) MWF ingredients.

Short chain chlorinated paraffin's.	Biocides	Nonylphenoethoxylates.
<p>Short chain chlorinated paraffins (SCCP) were used as lubricants in both watermiscible and neat oils. Studies have shown that these lubricants are toxic to the aquatic environment. Therefore, they are banned from metalworking fluids. Legislation is already implemented in the Netherlands that forbids the use of these SCCP in metalworking fluids.</p> <p>Alternatives to the SCCP are the Medium Chain Chlorinated Paraffins also chlorine-free alternatives.</p>	<p>Until recently probably the most widely used bactericide in metalworking fluids was Hexahydro-1,3,5-tris-(2-hydroxyethyl)-5-triazine.</p> <p>The EU has decided to classify this material as skin sensitiser from a concentration of 0.1%. In practice this would mean that metalworking fluid in use would be considered skin sensitizers (= may develop a skin allergy). Because it was expected that workers would not accept this labelling, most if not all metalworking fluids were reformulated to overcome this labelling. At this moment the biocide directive is in force which means that a lot of data on biocides will become available within the next 5 - 10 years. The members of the Stewardship Group have the advantage of participating in these discussions and will be kept up to date regarding any new information regarding biocides.</p>	<p>Nonylphenoethoxylates (NPE) are used as emulsifiers and washing agents. The concern with NPE is that they break down in the aquatic environment to nonylphenol (NP). This NP is poorly biodegradable and has the tendency to bioaccumulate. The NPE are banned for use in the Scandinavian countries and it is expected that they will be banned within the EU in the future.</p>

Table: examples of some (old) raw materials of MWF.

PRODUCTS

Product development.

After having discussed the raw materials to make the modern metalworking fluid, we can now discuss the challenges we face to develop modern metalworking fluids. A successful fluid has the optimum balance between commercial, technical and HSE aspects. One of the HSE aspects is the labelling

of these products for which the ruling laid down in EU guidelines, known in the UK as COSHH (Control of Substances Hazardous to Health) regulations.

Depending on the labelling and the concentration of raw materials, the label of the metalworking fluid can be established. In addition it is possible to test some of the HSE aspects of each specific product as described in the table on Page II.

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Skin tests.	Mist tests.	Environmental tests.
Several tests exist to investigate if the metalworking fluid does not increase the risk for skin irritation. One of these tests is the Trans Epidermal Water Loss, TEWL, test: the product in working concentration is applied on human volunteers for a certain time (1 to 5 days). After this time the skin is investigated visual, measuring the colour change (change to red means more irritation) and the change in water loss (the higher the water loss the higher the risk for skin irritation).	When metalworking fluids are used, mist consisting of small liquid droplets in the air, may be formed. Mist levels should be kept low to improve operator acceptance, and for health and safety reasons. Important factors that influence mist include flow rate and mist collectors, but also fluid composition and the fluid condition such as the presence of leak oil. Equipment is available to simulate working conditions in the laboratory. In this way, metalworking fluids can be developed which produce a low amount of mist. In addition, factors that influence mist, such as tramp oil, can be measured and quantified.	Starting on the first of July 2002, the environmental aspects of metalworking fluids must be included on the safety data sheet. This is common practice in Germany where the Water Endangering Class (WKG) has been known for many years. The characteristics of the aquatic environment can either be based on raw material information, which is the preferred method, or the product can be tested. If tests should be used, then three organisms are to be used: fish, daphnia and algae. It is estimated that modern metalworking fluids will have an effect on these organisms (LC ₅₀ , EC ₅₀ or IC ₅₀) if the concentration is above 10 mg/litre. By definition this means that the label 'toxic for the environment' (dead fish and tree) is not needed on metalworking fluid concentrates, but the risk phrase: "R52/53: harmful to aquatic organism. May cause long-term adverse effects in the aquatic environment" may be needed for certain products.



Photo: Mist generator

Table: Some HSE tests for products.

PRODUCTS IN USE.

Immediately after filling a machine with MWF, the fluid is attacked by micro-organisms and salts in the used water. During use certain ingredients are depleted, whilst other lubricants such as hydraulic and slide way oils may

contaminate the fluid. A good maintenance program helps to extend the fluid life. An essential part is to record analysis data of the MWF, as indicated on the sheet below.

MONITORING SHEET

System name	CUSTOMER												Product	CIMSTAR	
System size	25m3					Mix concentration									4%
Lab. Analysis	Limit values														
	Min.	max.	13/11	20/11	27/11	4/12	12/12	2/1	8/1	15/1	22/1	29/1	5/2		
pH value	8.7	9.1	9.1	9.0	9.0	8.7	8.9	9.0	9.1	9.0	9.0	8.9	8.8		
Concentration % mix	3.5	5	4.9	4.6	5.0	4.4	4.1	4.1	3.8	3.6	3.6	3.8	4.0		
Bacteria/mould/yeast	0-0-0	5-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0	0-0-0		
Tramp oil	0	1	0	0	0	0	0	0	0	1	1	1	1		
Week			0	1	2	3	4	7	8	9	10	11	12		
Notes			OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK		

Factors that influence fluid life are concentration, bacteria levels and tramp oil. Typical fluid life can be increased from 6 months to three years or more, if these factors are maintained within the desired ranges, especially when demineralised water is used for topping up.

With the increasing environmental awareness as well as higher disposal costs it becomes more economical to invest in fluid maintenance such as leak oil removing equipment.

The need for maintenance, especially for water-based products, leads to the discussion of minimal or even dry lubrication. Undoubtedly these methods are successful in certain applications, but it remains necessary to review the complete process. During a recent presentation in Germany, it was asked if nickel dust and nickel oxide dust (a known carcinogen) could form a health risk when dry machining high nickel containing alloys (Rocker, 13th International Colloquium Tribology, January 2002, Esslingen, Germany)

WASTE TREATMENT.

Metalworking fluids are removed from the system by work pieces, metal

finishes, mist collectors, etc. Sometimes this fluid is collected and returned to the system, but this is not always practical since the MWF will become contaminated with bacteria. In this case the fluid has to be disposed of. Another waste stream occurs after a replacement of the MWF.

It is estimated that in the UK 400,000 tonnes of metalworking fluid is disposed of every year.

The main principle of waste treatment is to separate the wastewater into an aqueous phase and an oily phase. The aqueous phase may be discharged into a sewer, if permitted by local authorities. The oily phase can be sent to a licensed waste treatment company. It is usually more expensive to dispose of the oily phase if chlorine is present, therefore chlorine free products are on the market.

For the separation of MWF into an aqueous and an oily phase, several techniques are available, such as ultra filtration, biological treatment and chemical breaking.

LUBETECH

Ultra filtration.

The heart of an UF system is a hollow fibre membrane cartridge. Wastewater flows through the inside of each hollow fibre. The pressure inside the fibre forces water and small molecular weight compounds through the membrane, while emulsified oil and large organic molecules are kept in the main stream.

Each time the waste is recirculated through the fibre, a fraction of the water in it passes through the membrane, ready for discharge to the sewer (pending local authority permission). The stream of waste is gradually dewatered, leaving behind an oily wastewater concentrate, which can be sent to a licensed waste treatment company.

Chemical breaking.

The fluid to be treated is pumped into a reaction tank. Chemicals are added, the fluid is left idle for the separation to occur, usually overnight. The next day the lower aqueous phase is removed from the upper oily phase. The aqueous phase is usually treated further, e.g. neutralised, before discharge.

Chemicals used include aluminium sulphate, sulphamic acid and polymers. Because the composition of the wastewater varies from batch to batch, the exact chemicals and their quantities are tested in a laboratory.

Biological treatment.

The principle of the method is not new and has already been in use for many years to treat domestic sewage. Specialized microorganisms under oxygen-rich (aerobic) or oxygen deficient (anaerobic) conditions can degrade almost all components of MWF effluent, including synthetic ones. The bioreactor can either be used as the principle treatment or as a polishing treatment.

Table: examples of waste water treatment procedures.

CONCLUDING REMARKS.

The British Lubricants Federation Metalworking Fluid Stewardship Group was initiated by the BLF since it was felt that in other countries the health, safety and environmental aspects of metalworking fluids play a more pro-active role than in the UK.

Member companies have the advantage of staying up to date with current and proposed new legislation.

All members of the Group have signed a Code of Ethics and subscribe the principles of Product Stewardship.

All are committed to work with suppliers, customers and regulatory authorities to reduce the health and environmental impact of metalworking

fluids. As a result they would expect that metalworking fluids from members from the Stewardship Group becomes the first choice of customers who recognise the importance of good HSE practice. Member companies are easily recognised by the PSG logo.

This article is written by the chairman of the British Lubricants Federation Metalworking Fluid Stewardship Group, B.J.Boomkamp of Cimcool Industrial Products B.V. Although great care has been taken to write this article in the spirit of the Product Stewardship Group, some items may be the opinion of the writer only.

FURTHER READING:

General

- > Fact Sheet Water-Mix Metalworking fluids from the British Lubricants Federation (telephone 01442 230589, website www.blf.org.uk). This sheet gives a useful reference literature list.
- > Guidance Note EH 62 from the Health and Safety Executive. Telephone: 01787 881165 or website: www.hsebooks.co.uk
- > Jerry P. Byers (editor): Metalworking fluids, publisher: Marcel Decker, 1994.
- > Optimizing the use of metalworking fluids, booklet from the Environmental Technology Best Practice Programme (telephone 0800 585794).

EU guidelines:

- > Website: <http://ecb.jrc.it>

Mist:

- > Boomkamp, B.J.: 'Metalworking fluids and mist' presented during the 11th International Colloquium, January, 1998, Esslingen Germany. Also published in: K.hlschmierstoffe und Zerspanung, Band 555, Expert verlag, Esslingen, August, 2000.

Skin tests:

- > H.ner,A., Fartasch, M., Hornstein, O.P., Diepgen, T.L.: The irritant effect of different metalworking fluids. Contact Dermatitis 31: 220-225 (1994).

Biological Treatment

- > A guide to Biological Treatment for Metalworking Fluids Disposal, Bio Wise, Help line: 0800 432100, Web site: <http://www.dti.gov.uk/biowise>

PSG members and associated partners (March 2002):

Members

Benj. R. Vickers & Sons Ltd.
Castrol International.
Cimcool Europe B.V. UK Branch.
Cognis Deutschland GmbH & Co. KG.
Croda Application Chemicals.
Crompton Europe Limited.
D. A. Stuart Limited.
Fuchs UK Plc.
Houghton Plc.
Kuwait Petroleum International Lubricants UK.
Lubrizol Limited.

Morris Lubricants.

Clariant UK Ltd.

Polartech Limited.

Quaker Chemical B.V.

RODS UK Limited.

Schulke and Mayr UK Ltd.

TotalFinaElf GB Limited.

Associated partners:

Robens Centre.
BLF Council.
Environment Agency.
Health & Safety Executive.



LUBETECH

e-COSHH ESSENTIALS: A FREE INTERNET TOOL TO HELP YOUR COMPANY COMPLY WITH COSHH REGULATIONS

The BLF attended the recent launch of The Health and Safety Executive (HSE) new internet tool "Electronic COSHH Essentials". The web-page driven internet tool is a highly sophisticated system designed to help industry prevent the harmful effects of working with chemicals by providing advice to limit exposure, in accordance with the COSHH Regulations.

The initiative - "Electronic COSHH Essentials" - is a free Internet package that anyone can use. Employers, safety representatives or employees can log on to www.coshh-essentials.org.uk and work out what needs to be done to control chemicals in use in the workplace.

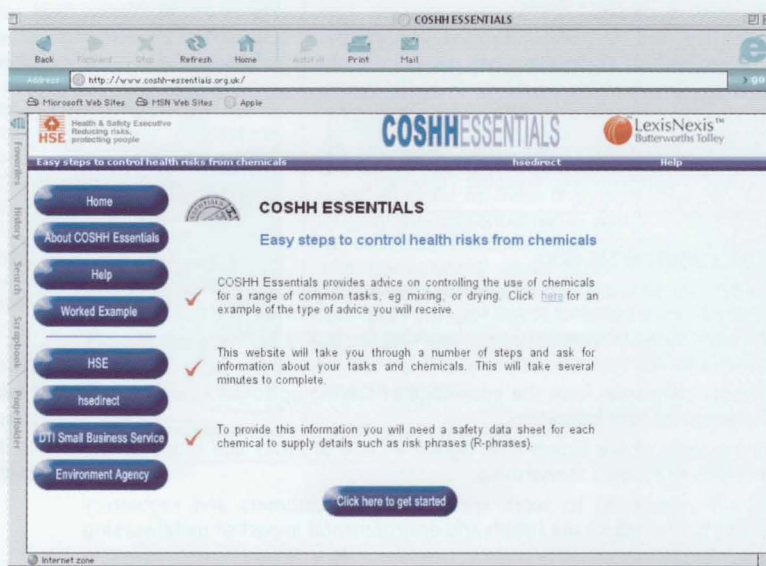
Thousands of people every year are made unnecessarily ill from working with chemicals. These illnesses can include asthma, dermatitis or in some cases even cancer. These illnesses can be avoided, provided that people working with the chemicals take appropriate measures to limit exposures, which sometimes can be as simple a matter as providing sufficient ventilation.

Speaking at the launch, Dr Alan Whitehead MP, Minister responsible for Health and Safety at Work, said "I wanted to be here to launch this innovative product that can make a real impact on workers' health. My congratulations to all concerned in its creation, and I hope that people will take the message away with them that Electronic COSHH Essentials is an important tool for the future of workplace chemicals control."

John Monks, General Secretary of the TUC, who also spoke at the event, said "There is nowhere to hide from chemicals at work. Machinists use them, hairdressers use them, printers use them and farmers use them. But they must use them safely. Unions welcome anything that makes it simpler to work safely, and COSHH Essentials is certainly that."

Chris Money, Exxon Mobil also presented at the launch, he provided a practical demonstration of the system live and showed how easy it was to produce a useable assessment of a typical industry process. Gerry Martin, Operations Manager of Haymans Ltd blenders and processors of fine alcohols, solvents and potable spirits gave another practical overview of how the new system performs.

1. COSHH requires employers to:
 - a) Assess the risks to health from exposure to hazardous substances;
 - b) Prevent or adequately control exposure;
 - c) Ensure that control measures are used, maintained, examined and tested;
 - d) In some instances, monitor exposure and carry out appropriate health surveillance; and inform, instruct and train employees.
2. "COSHH Essentials" has been around in a paper-based format since 1999, and has been highly praised by both industry and trades unions. The Internet version will broaden the access to this guidance package allowing anybody to use the tool free of charge.
3. It is aimed at small and medium sized businesses and is a simple step by step guide leading to identifying the correct control approach for each chemical used. It works by allocating the Risk phrase(s) for each chemical, taken from a Safety Data sheet, to one of four hazard bands. Then by defining how much of the substance is being used and for what purpose.



4. COSHH Essentials works so well because it does not rely on measurement, which can be expensive for small firms, and research within the industry has shown that businesses do not understand the two limit system (OELs and MELs) currently in place.
5. HSE is currently carrying out a review of the present OEL framework with a view to revising it into a simpler one-limit system that is more readily understood and aim to have this in place by Spring 2004.
6. The new electronic system will allow more sophisticated calculations to go on behind the scenes while keeping the front end simple and easy for the user.

A series of one-day seminars organised by British Institute of Occupational Hygienists (BOHS) in conjunction with HSE will present the electronic version of COSHH Essentials and discuss options for the new OEL framework. The Seminars will held in: -

London	-	22 May	HSE Rose Court
Glasgow	-	29 May	Hilton Hotel, Strathclyde
Glasgow	-	12 June	Thistle Hotel
Sheffield	-	19 June	HSL Broad Lane
Birmingham	-	26 June	Britannia Hotel

For details contact: BOHS, Suite 2 Geogian House, Great Northern Road, Derby, UK. DE1 1LT.

The seminars will cost £59 for BOHS Members, Non-members pay £69.

LINKS

BOHS: Tel: 01332 298101
Fax: 01332 298099
www.coshh-essentials.org.uk
www.hse.gov.uk