

In co-operation with the EC and the senator for work in Bremen ACMOS participates in a project (KÜSI) in the regional programme Work and Technology which concerns itself among other things with the development and the application of suitable cooling lubricants in metalworking.

### **Project KÜSI in the regional programme Work and Technology of the Hanseatic city Bremen**

Innovative research requires frequent meetings of different resources and competence by formation of cooperative networks.

In the project KÜSI partners from the fields of microbiology, production engineering as well as other organisations, work together. The results are transferred to the production plants of several suppliers and are evolved into changes where appropriate.

As project sponsor we are confident that the results serve to safeguard workplaces and lead to improved safety at work and health protection.

### **Cooling lubricants in metalworking**

Since the 20th century cooling lubricants have been used in metalworking in machining processes like turning and milling. The benefits are immense.

A milling cutter which cuts a 10 mm deep groove in a steel material with 22 m/min and a feed of 43 mm/min is worn out without cooling agent after milling of approx. 0,6 m. Nevertheless, with a cooling lubricant a stability of 3,2 meters is reached. Besides, cooling lubricants make the working process faster and improve the quality of the component parts.

However, accuracy in handling is essential because cooling lubricants are classified as hazardous materials. Although some substances, such as PCP (pentachlorophenol) and chlorine, are forbidden ingredients at the present time. There is further need for research and action here. Primarily skin irritations and general health disturbances belong to the health risks.

As cooling lubricants - apart from pure oils, predominantly oil-in-water emulsions are used. An emulsion consists of approx. 94% of water and 5% of oil. The remaining 0,5 - 1% contain up to 60 so-called additives. With their chemical properties they determine the usage characteristics. Emulsifying agents create a good mixture of oil and water; corrosion inhibitors suppress rust; chemical lubricants increase the lubricating effect of the oil; EP substances guarantee lubricating power with extreme pressures; defoaming agents suppress foaming and biocides hamper the growth of bacteria, yeast and fungi. Efficient cooling lubricants developed by our manufacturing processes are a high-quality chemistry product.

However, during their application water miscible cooling lubricants are subject to chemical and microbial changes. The technological application is therefore limited and expensive for the change and the disposal of used emulsions accrue. Besides - and here no compromises are allowed - disadvantageous effects on industrial safety and health protection must not be compromised.

For the exposure of connections between production engineering and industrial safety microbiological and production related examinations take place for a period of two years in production. In addition, organizational conditions are examined in the plant and with suppliers. With it the technical application should be optimized and the highest standards for industrial safety achieved.

### **Cooling Lubricant Safety Management (KÜSI)**

Modern production management contains an intelligent material management which orientates itself by health- and environment-relevant guidelines.

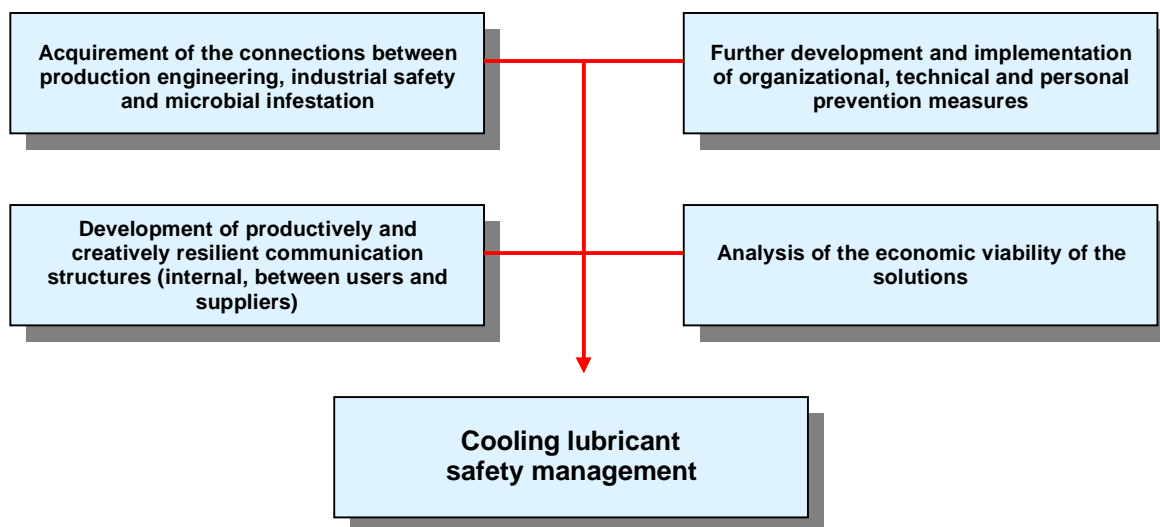
The ignoring of risks causes higher consequential costs than appropriate prevention. The careful selection, correct care and maintenance as well as the right individual protection whilst applying cooling lubricants guarantee increased industrial safety, protect the machining tools against wear and improve the quality of the parts to be produced.

Within the framework of the project KÜSI a safety management for cooling lubricants in an enterprise is well established.

In health and safety circles, the production manager, the cooling lubricant agent, the company physician and co-workers from the production cooperate with representatives of scientific institutes (ABC, ECO centre, MPA). In addition, suppliers bring their practical knowledge from decades of practice (ACMOS: cooling lubricants; Polo: filtration units; Schülke & Mayr: biocides).

The existing maintenance system of cooling lubricants is developed within the framework of this project. By extensive analysis knowledge, any gaps are detected. This applies particularly to the infestation of the cooling lubricant by microbes, suitable test methods and the connection between cooling lubricant condition and process safety (foaming, aerosols, filtration, final result). The results are realised at a milling machine and a turning centre. The know-how of the practitioners from the production plant is gained by learning from the experience of the operatives.

### **Project aims**



### **Microbiology of the cooling lubricants**

The human body with its own ecosystem is populated by a large number of microbes, mites and amoebae. Of the trillions of cells in our body about 90 per cent belong to these creatures, mostly bacteria whose living space is the human being. On the skin of a human being there are as many microbes as people living on our planet. Without these "co-inhabitants" human life would not survive. The skin flora contains the hydro-lipidic layer and protects us against the penetration of pathogenic bacteria. In the intestine bacteria help aid the digestion and provide the human being with vitamins.

Bacteria are found also found in every environment inhabited by man. Cooling lubricants they are brought into the cooling lubricant circulation by among other things, the tap water while mixing, an already existing settlement in the production line or by the operator. This is why a hygienically perfect behavior in dealing with cooling lubricants is so important. Left over food or cigarette butts are well known nutrients for microbes and they contain additional germs. The predominant part of bacteria found in cooling lubricants is completely harmless for human beings. If its number exceeds  $10^6 = 1$  million germs per ml the emulsion should be changed.

Bacteria change cooling lubricant in its physically / chemical abilities. The frequently measured fluctuations of the nitrate and nitrite level can be explained by, for example, activities of different bacteria. Cooling lubricant can lose some of its qualities because, e.g., corrosion inhibitors, bonding agents, emulsifying agents, biocides or other additives are "eaten up" by bacteria. In central units when a post-dosage is carried out at single filled machines very often only then a change is possible.

With which kind of bacteria cooling lubricants are infested and how these infestations have an effect is only partly known. Therefore, KÜSI aimed for harmful microbes. Furthermore the effectiveness of biocides and impact of hygiene and maintenance measures are examined.

So it was ascertained that by the addition of a corrosion inhibitor instead of improved rust protection an unwanted increase of germs took place. In further tests the cause could be linked to the corrosion inhibitor as a food source for bacteria.

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