CINCINNATI MILACRON

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Dear Dr Niemeier:

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We are grateful for the opportunity to respond to your request for comments and secondary data as outlined on page 20637 of the May 18 issue of the *Federal Register*. Cincinnati Milacron Products Division is one of the major suppliers of water-based metalworking fluids, with over 40 years of experience in developing and marketing these products. In addition, we manufacture grinding wheels and our parent company is one of the leading manufacturers of metalworking machines giving us a unique perspective on all aspects of the metalworking process.

General comments

A brief overview of what metalworking fluids are and how they function is given in Attachment 1, and in the video tape *Cool Chips* (enclosed).

1. Basis for the selection and use of a specific cutting fluid formulation for a specific type of metalworking.

Fluid selection is a complex process and quite often is based on criteria other than simple performance. In general, the severity of the application is determined by the properties of the workpiece, the metal removing process (turning, milling, grinding), the rate of metal removal and the mode of fluid application. Fluid capabilities range from heavy duty through general purpose to light duty. Somewhere within this range, it should be possible to find a fluid which is adequate for the particular application at a minimum cost. In actual practice, a non-optimum fluid may be chosen. Often, several operations may take place at a given location where it is desirable to use only one fluid which is optimum only for one of the operations. Fluid selection is often determined by compatibility with waste disposal operations, with a sacrifice in fluid performance. An inferior fluid may be chosen because of perceived differences in cost based on a per gallon price. Most fluids offered for general sales are "over-formulated" so that they can be applied to a range of applications. This helps to reduce the number of products in a product line and reduces the level of control needed to assure proper product performance in use. As a result, many products would be suitable for a given application and fluid selection is not a critical step.

A more detailed discussion is given in Attachment 2.

2. Average length of use of different cutting fluids

The decision to change metalworking fluids is usually made independently of any concern about the condition of the fluid. Where each machine has individual sumps, the fluid is usually removed to allow removal of metal chips form the sump. General practice is to dump the fluid at this time, although many shops now save the fluid and return it to the tank after filtering. There is equipment now on the market which can be used to remove contaminant oil from the fluid and sterilize it so that it can be treated with concentrate or additives and recycled to other machines. In such cases, the condition of the used fluid approaches that of a new fluid.

In central systems, where a single tank circulates fluid to several machines, the fluid is routinely filtered before reuse. In such cases, use of the fluid continues beyond the point where an individual machine sump would be recharged. With proper fluid maintenance, the working life of the fluid has been as long as 8 years. Typical fluid life in a well-run central system is 1-2 years. Unsatisfactory fluid performance is seldom the reason for fluid replacement; the usual reason is mechanical malfunction or mechanical maintenance of the system components. In those cases where fluid failure is the reason for replacement, failure to maintain fluid condition is the most frequent root cause of the problems.

3. Types and concentration of additives in new and used cutting fluids

In general, the use of the term "additives" is used in connection with straight oil fluids. In the case of water-based fluids, the appropriate term would be "ingredients" or "components".

The chemicals used to formulate metalworking fluids fall into eight very broad classes: oils, sulfonates, fatty chemicals, amines, biocides, ethoxylates, inorganics and "others". With the exception of the oils, these chemicals are very commonly used in toiletries and personal care products. Such materials are attractive because they are available in quantity at reasonable prices and have known toxicological properties.

Oils are primarily low viscosity naphthenic or paraffinic lube stocks, either severely solvent treated or severely hydrotreated. Levels in fluid concentrates may range from 80% to 5%, with dilution factors of 10 to 40 times used in making mixes.

Sulfonates are used as emulsifiers to make the oils miscible in water. They are typically the by-product of manufacturing white oils from crude oil by the sulfuric acid process, as opposed to the alkylaryl sulfonates used to make detergents. As a crude measure, the sulfonate content of a fluid will be one-fifth of the oil content.

Fatty chemicals are derived from tall oil, lard oil, tallow, soy bean oil or other animal or vegetable oils. They may be present as the oils themselves, as the fatty acid mixtures derived from those oils, esters and amides of the acids or as sulfurized oils. They function as emulsifiers, corrosion inhibitors or lubricants. Levels in fluid concentrates are typically 10% or less.

Amines are most frequently the ethanolamines or the isopropanolamines, although other alkanolamines are sometimes used. They function as corrosion inhibitors, humectants, residue modifiers and help to buffer the final product mix at a desirable pH. Levels in fluid concentrates are typically 10% or less.

Biocides are chemicals which have been cleared by EPA for use in metalworking fluids under the provisions of FIFRA. With one exception (tris(hydroxyethyl)triazine), the major markets for these chemicals are outside the metalworking industry, either in toiletries or in paints and coatings. Levels in product concentrates are typically less than 1%. The most important types of biocides used in metalworking fluids are phenolics, triazines, oxazolidines, nitromorpholines, adamantanes, salicylanaidies and isothiazolines. These compounds are biologically active by definition and have been tersted and are being tested as part of the registration program.

Ethoxylates are the condensation products of ethylene oxide with alkylphenols, alcohols, fatty acids, amines or water. They act as wetting agents, emulsifiers, lubricants, mildness agents and, in some cases, as defoamers. Concentrate levels are usually less than 5%.

Inorganics include caustic soda, caustic potash, borates, phosphates and silicates. Concentrate levels are less than 5%.

Other chemicals are dyes, odorants and defoamers. Typical levels are well below 1% in fluid concentrates.

4. Methods for evaluation of the quality of used cutting fluids and basis for disposal or reuse

Fluid condition is determined on a weekly basis in central systems by conducting a series of analyses for various fluid components to assure that all components are present at the proper levels, both absolutely and relative to each other. In addition, checks are made for contamination by dirt, oil and microorganisms. If fluid condition is good and no trends indicating degradation of condition are noted, continued satisfactory performance of the fluid can be expected. More detailed information is given in Attachment 3.

5. Methods and testing intervals to evaluate cutting fluid pH, effective additive concentrations and contaminant levels

Most metalworking shops do not have the capability to conduct analysis of their fluids. The most common in-plant method of fluid checking is measurement of refractive index. In some cases, small titration kits are available for checking levels of anionic emulsifiers or for checking alkalinity. The use of hazardous solvents or reagents restricts the use of these methods when a laboratory is not available. The most common method of on-site evaluation is a visual check for mix stability, contamination by oil or microorganisms and the absence of odors. pH values can be used as a rough check of fluid condition to indicate gross contamination or uncontrolled microbial activity.

Individual fluid components can be measured in a laboratory by volumetric titrations of emulsifiers and alkaline components. These methods are non-specific and are subject to interferences from contaminants. Non-specific tests such as fluid conductivity can also be used. More "modern" techniques such as TLC, HPLC, FTIR or electrochemical methods can be used, but are not generally accepted within the industry because the interpretation of results is not straightforward.

Testing frequency is normally done weekly, unless a local lab is available; testing is then done each shift. Electronic monitors which are capable of hourly measurements are available, but their use is not common.

6. Description of the types of contamination found in cutting fluids

See Attachment 4.

7. Description of methods for refining or processing used cutting fluids

See Attachment 5.

8. Health effects related to occupational exposure to cutting fluids

The most common reported health effect involving metalworking fluids is skin irritation. This invariably results from poor fluid control (concentration too strong) or fluid contamination by oil, metals or cleaners. In our experience, we receive roughly two complaints of skin irritation for every 100,000 gallons sold. Discussions of dermatitis, its causes, prevention and treatment are in Attachment 6.

As noted, most of the ingredients in metalworking fluids are also used in personal care products such as shampoos, make-up, skin creams, etc. While the analytical methods do not exist to measure actual workplace exposures to the individual chemicals, it is possible to estimate these levels and to make a worst-case exposure. In every case, this is well below measured adverse effect levels found in animal tests. Specific examples are given in Attachment 7.

Caution should be used in extrapolating test results for individual chemicals to formulated products. Many of the individual chemicals are acidic or alkaline and the toxicity tests reflect these properties. In the final fluid, such adverse effects are absent because the acids and bases have been neutralized. The important test results are those for the total product. In that regard, our toxicity tests for **concentrated** products consistently show the products to be non-toxic. Some fluids even give negative tests for primary eye irritation. The most severe adverse effects observed are positive test for primary eye irritation and primary skin irritation (see Attachment 8). In every case, dilution of the product to 10% eliminates the positive response.

Most older epidemiological studies on metalworking fluid exposure are flawed in that they do not identify the type of fluid involved and reported effects cannot be ascribed to the use of a specific fluid type. More recent studies are more complete. Reprints of some of these studies are included in Attachment 8.

9. Airborne concentrations of fluids in the workplace

OSHA has set a nuisance value PEL of 5 mg/M^3 for oil mists. Mist levels at machines using straight oils are typically well below this level. For water-based fluids, the only PEL that would apply would be the general particulate level of 10 mg/M^3. Again, this level is rarely approached in normal machining environments.

There are no recognized methods for measuring aqueous mists or their components in the workplace. Most commonly, a gravimetric determination of the total mist is attempted. This technique is subject to errors caused by evaporation of the water during sample collection.

Determination of individual chemicals is difficult because they are present in the fluid itself at 1000 ppm or less and often cannot be directly detected at these levels unless large sample volumes are used. Collection of large sample volumes from the air in a reasonable time (hours) is not often practical. The most practical approach is to measure the mist level as water itself and to calculate the levels of chemicals from separate analyses. The best estimates of aqueous mist exposure levels that have been published would be in the range of 2 mg/M^3 or less, averaged over a full work day. At these levels, exposure to a component present in the concentrated product at level of 10% and after dilution by 20 times with water would be 0.01 mg/M^3.

10. Practices to limit exposure to cutting fluids

The recommendations given in the *Critical Intelligence Bulletin* of 1976 summarize prudent practice in the use of metalworking fluids. In general, common sense, good housekeeping and personal hygiene will minimize exposure and problems.

Much of the information in the Attachments is part of our product literature and is circulated to our customers and others. However, the information on those pages marked as "COMPANY CONFIDENTIAL" is considered by us to be proprietary and should be treated as Confidential Business Information.

If you have any further questions, please contact me at 513-841-8050.

Very truly yours,

W. E. Lucke

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