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November 10, 1994

Dr. Richard Niemeier - Director DSDTT
U.S. Department of Health and Human Services
NIOSH
Taft Laboratory, DSDTT
4676 Columbia Parkway, C-32
Cincinnati, OH 45226

RE: COMMENTS REGARDING THE CHEMISTRY OF METALWORKING FLUIDS

Dear Dr. Niemeier:

The manufacturers of metal cutting/machining fluids may generally claim their products as supplied to customers are safe (from an exposure viewpoint). However, the contamination of these fluids "in use" may be of more realistic concern. I have listed below some areas worthy of further investigation.

I. The type of metal being machined:

In any machining process utilizing a metalworking fluid, a portion of this metal dissolves into the metalworking fluid. Therefore, exposure to certain metals exists in the metalworking fluid. Some examples are:

Metal being machined	Potential soluble contaminant
Leaded steels	lead
Leaded aluminum	lead
Leaded brass	lead
Stainless steel	nickel, chrome
Galvanized steel	zinc
Cast and ductile irons	mercury, lead, zinc, copper, (depending on casting source)

II. The type of metal removal process:

Single point machining processes generally produce large particles versus grinding processes that, under certain circumstances, can produce metal fines below 40 micron. As the size of the removed metal particle decreases, the net surface area increases per volume of metal removed. The amount of metal adsorbed into the metalworking fluid is directly related to the total amount of surface area exposed to the machining fluid.

III. Type of fluid used in the machining process:

The straight oil type products absorb fewer metals than water miscible products. Basic emulsified oils appear to be less reactive than semi-synthetics, and semi-synthetics appear to be less reactive than synthetic fluids.

IV. Type of water used for make up:

Some water supplies contain high levels of nitrite and/or nitrates

V. Chemistries of the fluids:

[Covered somewhat by the ILMA]

VI. Chemistries of intentional in situ additives:

Categories	Ingredients
Biocides	too numerous to list
Fungicides	too numerous to list
Corrosion inhibitors	chromates, nitrites, amines, remainder too numerous to list
Chelating agents	salts of EDTA
pH control compounds	sodium hydroxide, triethanolamine, sodium borate
De-foamers	silicone emulsions
Emulsifiers	sulfonates, non-ionic surfactants, remainder too numerous to list
Coupling agents	ethylene glycol monobutyl ether, non ionic surfactants
Lubricant enhancers	extreme pressure products, organic chlorine, sulphur, phosphorus, animal fat, fatty acids, remainder too numerous to list

VII. Chemistries of unintended in situ additions:

Categories	Types. ingredients
Tramp oils	emulsifying types
Tramp oils	dispersing types
Tramp oils	containing zinc dialkyldithiophosphate and related compounds
Alkaline cleaners	too numerous to list
Co-solvents	ethylene glycol monobutyl ether
Mineral spirits	poly aliphatic hydrocarbons
Tramp metals	as in category I above
Anions	as phosphate, sulfate, carbonates, bicarbonates
Bacteria	too numerous to list

VII. Chemistries of unintended in situ additions, continued:

Fungus	mold, yeast, remainder too numerous to list
Food	numerous types from workers
Human waste	spit, urine
Paint residues	too numerous to list
Rust preventatives	from other suppliers
Slushing oils	from steel mills
Cross contamination	straight oils into emulsions and vice versa from prior operations

VIII. Inter-reactive chemistries:

Inter-reactions of categories I, II, III, IV, V, VI, VII

Other factors that influence the solubility of contaminants into metalworking fluids.

IX. The volume of the recirculating system:

A small machining tank (sump) will saturate faster with dissolved metals (and other chemicals) than a proportionally larger system.

X. Temperature of the recirculating fluid:

Obviously, as the temperature increases, certain metals and other chemicals increase in solubility. Fluid temperature rarely exceed 110°F

XI. Age of the recirculating fluid:

The older the fluid, the higher the solubility of metals and other chemicals.

Most of the above information was not mentioned at the meeting on November 2nd and 3rd. Trying to put metalworking fluids into "simplified" categories as virgin products may not be realistic. The products in use become contaminated so quickly that, in many cases, the hazard potential of the fluid in use may have no relation to the fluid as supplied.

The information provided above is by no means inclusive. I would be glad to discuss this information with you in detail at your convenience. Contact me at the above address or by phone at (216) 523-6775.

John M. Burke
Manager of Environmental Engineering