Technical Bulletin

Master Fluid SOLUTIONS

Health, Safety and Environmental Affairs – Sources of Dermatitis

More than fifty years of making and servicing metalworking fluids (MWF) has taught us to look to a relatively short list of issues when trying to pinpoint the cause of dermatitis issues. Though this list is not all-inclusive, it covers more than 95% of all cases. When all data is assessed, the root of the problem overwhelmingly is linked to contact with contaminated, "used" working solution or another non-fluid related issue, rather than with clean new fluid.

1. **pH+** – Alkaline (systems with a pH of 7.0 or higher) materials injure the skin by actively removing water from skin tissues, damaging the keratin layer. The skin has a limited protection from such substances due to the buffering action of deposits on the skin's surface by eccrine (sweat) and sebaceous (oil) glands. But repeated or prolonged contact with highly alkaline materials can neutralize this protective barrier and allow the material to penetrate the skin, resulting in irritation. Alkali materials also tend to remove fats and oils from the skin by a process of saponification (the making of soap caused by alkali combining with fat).

   Acids (systems with a pH less than 7.0) attack the skin by reacting with and precipitating or coagulating proteins from the tissues. The major source of acidity encountered by machine tool operators working in water miscible cutting and grinding fluids is contaminant oils containing active sulfur or chlorine components. These are normally straight cutting oils with sulfur or chlorine additives that break down in the presence of water to form weak acids.

   Tank side additives and biocide additives can have a major affect on a system's pH. Biocides typically have a very high or very low pH. Corrosion inhibitors, surfactants, and emulsions help to stabilize and alkaline builders tend to drive up the pH. So care should be exercised in terms of add amounts, frequency and how they are added.
2. **Solvents** – Low boiling point organic liquids such as trichloroethane, trichloroethylene, carbon tetrachloride, kerosene, xylene, benzene, naphtha, and mineral spirits (Stoddard Solvent) pose a serious threat to the skin. These solvents are used most often in the metal removal environment because they rapidly dissolve grease and oils from metal parts – but they have the same effect on defatting oil from skin. Once the oil in your skin is gone, the skin looses much of its flexibility and moisture, causing it to crack and split and leaving it subject to attack from other materials.
3. **Metals** – Some metals themselves can be a cause of dermatitis. Included in this list are: zinc (Zn), cadmium (Cd), chrome (Cr), and nickel (Ni), all of which are recognized as primary skin irritants. Nickel can also be a sensitizing agent producing an extremely uncomfortable condition referred to as "nickel itch." The metal contact can occur from the chips, the bulk metal, or metal ions in a solution.
4. **Straight Cutting Oils** – The use of straight cutting oils can create a number of conditions unfavorable to skin. These oils contain an active sulfur or chlorine compound; if they come in contact with water, weak acids can form. Another potential problem with straight oil is its potential for plugging hair follicles, resulting in folliculitis or oil acne.
5. **Concentration Control** – Concentration control, or rather the lack of it, is a key failure mechanism for metalworking fluids. Any given fluid is designed to run within a given range of concentrations. This is typically expressed in terms of an upper and lower limit. As concentrations increase, particularly with synthetic and semisynthetic fluids, the possibility of dermatitis increases as well. If the concentration of the fluid is too low, there is probability of increased corrosion and bacterial growth. Because of their lower working pHs and the "soothing affect" of the oil, soluble oils are less susceptible to this problem than synthetic and semisynthetic fluids.
6. **Handling Equipment** – Galvanized (zinc and cadmium coated) piping and mixing vessels should be avoided with water based products. This is particularly true with synthetic and semisynthetic fluids because of their higher pH and reserve alkalinity. These fluids have a tendency to "solubilize" the zinc and cadmium from the galvanized coating, causing them to be primary irritants.
7. **Protective Creams** – Although protective creams can be useful in alleviating skin irritation, they must be used properly. The skin must be cleaned and dried thoroughly before each application to prevent fluid, chips, and fines from being trapped under them. Only non-

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medicated, fragrance-free products should be used. Medicated creams should only be used at the direction of a qualified health professional. Note that there are barrier creams designed to protect against water-based systems and others designed for use with oils or solvents.

8. **Germicides** – Germicides or biocides are designed to kill living organisms – and the skin is a living organism. Biocides are safe and effective only if used according to the manufacturer's instructions.
9. **Filthy Coolant** – Mechanical attack on the skin can often be traced to chips or swarf in the fluid and/or picked up by a shop rag. Keep the fluid and the work environment as clean as possible.
10. **Non-occupational exposures can cause skin irritations.** Some hobbies, second jobs, and leisure activities can take their toll on skin, such as:

    a. Gardening/yard work: sunlight, fertilizers, herbicide and pesticides, or just working in the soil can cause dry skin.
    b. Home mechanics: exposure to oil, grease, gasoline (an excellent solvent), and physical abrasion from mechanical work.
    c. Hiking/picnicking/camping: insect bites, poisonous plants, physical abrasions from trees and brush.
    d. Household jobs: detergents for cleaning dishes, floors and furniture, caustics such as drain openers and oven cleaning compounds.

    To effectively prevent industrial dermatitis there must be an active partnership between the fluid supplier, the using organization, and its workers.

Notes:

1. While the information in this Master Fluid Solutions Technical Bulletin is based on many years of experience with metalworking fluids, it cannot and should not be substituted for the advice of a medical professional who is experienced with the issues found in the metalworking environment.
2. If you encounter a dermatitis problem and decide to change out the cutting fluid, keep several pint samples of the "used" fluid so it can be evaluated by your fluid supplier and/or an independent laboratory or used in patch testing by a dermatologist at a later date.

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