

# COOL TALK



BY  
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# ITCHING FOR A SOLUTION

*The following discussion highlights some of the more common causes of dermatitis in the metalworking environment. By no means does this represent an exhaustive study of every possible cause of skin irritation to machine tool operators. But, based on years of actual field experience, we do review the problems most often encountered.*

Every job comes with its own set of aches, pains, and irritations. The strained back of the bricklayer, the burnt neck of the farmer, the bloody knuckles of the mechanic - these are but a few of the symptoms experienced by those who work for a living. Similarly, machine tool operators are no strangers to the "labor pains" peculiar to their profession - excessive heat, noise, and myriad machines just waiting to grab stray appendages are often high on the list of workplace woes. However, when discussing operator safety and satisfaction, no

topic comes to the forefront more often than dermatitis.

Occupational dermatoses is a term used to describe any abnormality of the skin induced or aggravated by the work environment.

Dermatitis is somewhat more specific, referring only to inflammation or irritation of the skin.

Occupational dermatitis is further characterized by type, as listed below:

*Primary irritation* results from a direct action on the skin at the site of contact, at the time of contact or shortly thereafter.

*Sensitization* is the result of an allergic reaction (immune-system response) to a given substance. Initial contact with the material may not cause irritation, but it may trigger a buildup or sensitivity to the material over a period of

time. Once the skin is sensitized, even the smallest amount of the substance can result in a severe reaction not necessarily limited to the site of contact.

*Photosensitization* is similar to sensitization except that the presence of light is required to activate the sensitizer.

The pH of human skin varies from one area of the body to another, but in general, it is slightly on the acidic side of the scale, at approximately 6.8 pH (7.0 is neutral). The skin also has a protective layer of natural oils that retards moisture evaporation and acts as a mechanical shield. Consequently, anything that tends to remove the natural oils from the skin or alter the skin's pH balance may produce dermatitis. There are four possible mechanisms that can induce dermatitis:

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*Mechanical injury* - friction, pressure, or trauma, including abrasion.

*Chemical Attack* - precipitation of protein by an acid.

*Physical agents* - excessive heat or cold, radiation, or electricity.

*Biological agents* - insect bites or contact with plants such as poison ivy, poison oak, and poison sumac.

### **Predisposing Factors**

First, we should consider certain elements that tend to increase an individual's chances for developing dermatitis. These indirect or predisposing factors include race, age, sex, skin texture, perspiration characteristics, seasons of the year, cleanliness, allergies, general health, and diet.

**Racial characteristics.** In general, people of light complexion, such as blondes and redheads, tend to have more sensitive skin than people with darker complexions. This is due mainly to the amount of pigmentation in the skin.

**Age.** Young workers seem to develop dermatitis more frequently than more seasoned workers. This may be because the skin of younger workers has not yet adjusted to the new work environment. The frequency of dermatitis in young workers also may be attributable in part to a generally greater disregard for exercising caution when handling potentially injurious materials. Veteran workers may have become acclimated to the workplace and thus may

have developed skin that is more tolerant. Conversely, as we age the natural oil content of our skin decreases, and this decrease can lead to an increased incidence of skin irritation in older workers.

**Sex.** Women tend to have drier, less oily skin than men have. This can translate into a higher sensitivity to many irritants, particularly solvents and detergents. Despite this fact, women tend to have fewer skin problems. This may be due, in part, to their more conscientious cleaning habits or to their willingness to report and obtain treatment for irritations when they first occur.

**Skin Texture.** Individuals with naturally dry skin may be more susceptible to the action of solvents and detergents than those with oily skin. Conversely, those with oily skin may be more susceptible to folliculitis or acne-type conditions caused by oils and similar materials.

**Perspiration.** Although perspiration is one of the body's natural defense mechanisms, it can actually serve to initiate or intensify the effect of an irritant on the skin. For example, perspiration on the hand may draw a material out of the lining of gloves that will irritate skin. Some materials may be irritants only when in solution, such as soda ash. Therefore, those individuals who perspire excessively could be more susceptible to skin irritation of this nature.

**Season.** Hot, humid weather usually results in increased perspiration with the associated problems noted above. Also, as the temper-

ature increases, operators tend to wear less clothing, thus exposing more skin to potential irritants. Warm weather also allows for increased exposure outside of the workplace to sunlight, poisonous plants, insects, etc., which all have potential effects on the skin. In addition, the use of heated air, which is low in relative humidity, depletes the skin's moisture.

**Cleanliness.** Both personal hygiene and cleanliness of the work environment can have significant impacts on the condition of the skin. Keeping the skin free of potentially harmful materials is the most effective way to prevent dermatitis.

**Allergies.** For genetic reasons, some people develop allergies or sensitivities to certain substances. This can occur with any material and quite frequently manifests itself partly or wholly as a skin irritation. The potential for developing allergies to metalworking fluids is comparable to developing allergies to certain cosmetics - that is, very small.

**Health.** Poor health can render the skin more susceptible to the causes of dermatitis. In addition, many medications taken to correct various illnesses can have skin irritation as a side effect.

**Diet.** A faulty or deficient diet may lead to extreme sensitivity in some individual. Also, the consumption of certain foods can, itself, elicit skin reactions.

The factors discussed above are generalized and are not applicable in every instance of occupational dermatitis. However, it is important to know these factors and to

keep them in mind when investigating such problems.

### **Specific Causes**

A huge number of materials or situations can contribute to the development of dermatitis. Let's now concentrate on some specifics associated with dermatitis and the use of water-miscible cutting and grinding fluids.

**Alkalinity.** Alkaline materials injure the skin by actively removing water from the skin and damaging the keratin layer. The skin has limited protection from such substances by virtue of the buffering action of various compounds deposited on the surface by eccrine (sweat) and sebaceous (oil) glands. However, repeated or prolonged contact with highly alkaline materials can neutralize this barrier, allowing materials to penetrate and act directly on the skin, resulting in irritation.

Two major sources of alkalinity in the metalworking environment are parts-cleaning compounds and cutting fluids. Most cleaning compounds are alkaline and must be used properly. Cleaners must be completely rinsed from the machine tool before recharging with fresh coolant. Water-miscible cutting grinding fluids have to be alkaline to achieve certain essential properties such as corrosion control on ferrous metals. At the same time, the fluid must be gentle enough for prolonged skin contact. In general, a pH greater than 9.0 in water-miscible cutting and grinding fluids should be avoided if prolonged skin contact is expected.

**Acidity.** Acids attack the skin by

reacting with and precipitating or coagulating proteins from the tissues. The chief source of acidity encountered by machine tool operators working with water-miscible cutting and grinding fluids probably 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.

**Solvents.** Low-boiling organic liquids such as trichloroethane, trichloroethylene, carbon tetrachloride, kerosene, xylene, benzene, naphtha, and mineral spirits pose a serious threat to the skin. These solvents, used as degreasers or cleaning agents for parts and machine tools, effectively remove the natural oils from the skin. Loss of this oil barrier allows moisture to evaporate from skin tissues, resulting in extreme dryness. As the skin loses moisture, it also loses flexibility. Thus, cracking may occur, particularly between the fingers. Removal of the protective oil screen also leaves the skin open to attack by other irritants.

**Metals.** Certain metals themselves can cause dermatitis. For example, zinc, cadmium, chromates, and nickel can be a sensitizing agent in some individuals resulting in an extremely uncomfortable condition commonly called "nickel itch."

**Straight cutting oils.** The use of straight cutting oils can create a number of conditions unfavorable to the skin. As discussed previously, if these oils contain an active sulfur or chlorine and con-

taminate a water-miscible product, weak acids will form. Such contamination may occur in several ways.

First, the oil may be carried on parts that are machined in the primary operation with a cutting oil, but then go to a secondary operation where a water-base product is in use.

Second, straight oils may be introduced into water-base fluid, but the operator is brushing on a straight oil for reaming, tapping, threading, or similar operations where extra lubricity is required.

Third, oils may be left over in the sumps, pumps, and pipes of machines previously run on straight oils and recently switched over to water-base fluids if the machines have not been properly cleaned.

Fourth, the operator's skin may be the oil carrier. Operators who have worked with straight oils for an extended period may find that their skin is saturated with oil. When they begin to work in the water-base fluid, there may be sufficient oil in their skin to cause a reaction when combined with water.

Another potential problem with straight oils is their potential for plugging the hair follicles, resulting in folliculitis.

**Filthy coolant.** Garbage in the coolant, such as beverage cans, food, paper, cigarette butts, saliva, and tobacco juice, can be an irritant itself. Also, if operators wash their hands and arms with coolant, which may contain sus-

pendent metal fines due to inadequate filtration, the skin may be cut or abraded.

**Biocides.** Misapplication of biocides can be extremely injurious to the skin. The materials usually have a very low or a very high pH and have effective ranges at the ppm level. Biocides should be used only as directed by the manufacturer.

#### **Handling equipment.**

Galvanized (zinc-coated) piping and mixing vessels should be avoided when using water-miscible products, particularly chemical fluids. Zinc, a primary irritant, may be drawn into the solution because of a water-base fluid's alkalinity.

**Concentration control.** Running water-miscible fluids within the recommended concentration range is crucial. In addition to the problem of alkalinity discussed earlier, many products have surface-active or detergent-like components that can wash away the skin's natural oil barrier. Reactions from this source are generally more prevalent with chemical fluids than with soluble oils.

**Protective creams.** Although protective creams can be useful in alleviating skin irritation, they must be used properly, or they can make the situation worse. The skin must be thoroughly cleaned and dried before each application, or the fluid, chips, fines, or other irritants may be trapped against the skin beneath the cream.

Also, care should be taken to ensure that a nonmedicated, water-barrier type of cream is

used. Medicated creams containing benzocaine or antibiotics such as neomycin may themselves be sensitizers to some individuals. Such creams should be used only under the direction of a qualified health professional.

**Contamination.** A large percentage of dermatitis problems occur as a direct result of contamination from external sources. Many times, since a sump is such a convenient place to dump liquids, things like floor-cleaning compounds, soaps, and detergents become mixed with the fluid.

#### **Outside activities.**

Sometimes skin irritation can result from or be exacerbated by off-the-job activities such as hobbies, second jobs, leisure activities, or work around the house.

##### *Gardening or yard work.*

Sunlight, herbicides and pesticides, and just working in the soil can dry out the skin.

*Home mechanics.* Exposure to oils, greases, and other petroleum products and distillates can damage the skin.

Furthermore, there is a high potential for physical abrasion during physical work.

##### *Hiking, picnicking, camping.*

These activities offer a good potential for insect bites, poisonous plants, and physical abrasion from trees and brush.

*Household jobs.* Detergents for cleaning dishes, floors, and furniture, as well as caustics such as drain openers and oven-cleaning



*Acid Burn.*



*Irritated skin from parts handling.*



*Day 1 irritated skin.*

compounds, should be used with caution and according to the manufacturer's directions.

#### **Solutions**

Now that we have looked at potential causes of dermatitis, let us turn our attention to what can be done to prevent or remedy dermatitis. Without a doubt, the single most effective method of preventing dermatitis is keeping

clean. Good personal hygiene is the key to minimizing skin contact with harmful agents. This entails washing up as frequently as needed with a mild soap in warm water and drying thoroughly, particularly in cold weather, to prevent chapping.

Although keeping clean is essential, it is important that it be done with appropriate cleaners. The use of solvents such as alcohol, gasoline, turpentine, paint remover, or degreasing agents should be avoided entirely. As mentioned earlier, such materials not only remove dirt from the skin but also remove the protective oil layer.

Water alone is not sufficient either. Soap is needed to remove water-insoluble irritants from the skin. However, it is important that the correct type of skin cleanser be used. Abrasive soaps and some of the powdered or granular soaps clean skin by physically abrading it. Use of this type of soap four, six, or 10 times a day can irritate the skin.

Waterless hand cleaners often contain materials harsh to the skin also. A mild bar or lotion soap is recommended for general use. For those individuals already

affected by skin irritation, the use of mineral-oil or oatmeal-type soaps may be helpful.

Good housekeeping is also an important element in the prevention of dermatitis. Contamination of the working solution by tramp oils, solvents, or garbage should be reduced as much as possible.

Proper use of barrier creams can be effective in controlling dermatitis. Protective clothing, such as gloves, sleeves, and aprons may be helpful in some instances, but care must be taken to make sure the clothing doesn't pose a hazard itself. For example, avoid wearing gloves when opening moving machine parts. The parts might snag the glove and pull fingers and hands into pinch points. Also, such protective clothing can pose problems similar to those caused by misapplied protective creams - perspiration or irritants may be trapped against the skin for extended periods.

Any skin irritation should be reported at once. The earlier such situations are reported, the better it is for everyone. Prompt notification of any abnormalities allows management to investigate the

source of the problem and remedy the situation before it develops into a serious irritation for the affected person and before co-workers develop similar reactions.

Cutting and grinding fluids designed with the operator in mind will be non-toxic and pleasant to use in addition to exhibiting effective cooling and lubricating properties. This means that fluids are clean; have a mild, inoffensive odor; and are gentle to the skin. However, even the best fluids need to be properly maintained and handled with the appropriate amount of caution, knowledge, and common sense.

If nothing else is garnered from this discussion, it is hoped that the reader will acquire an appreciation for the complexity of the occupational-dermatitis issue and recognition of some of its many variables. By observing the details of the situation, you can help prevent dermatitis by setting up proper procedures and controls. Remember, what gives one operator dermatitis may have no effect on another.

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