

Connecticut Department of
Public Health

Environmental Epidemiology
and
Occupational Health Division

METALWORKING FLUIDS

A Fact Sheet for Doctors and Their Patients

MWF may contain chemical ingredients, additives, and contaminants that are hazardous.

Hazardous contaminants may come from:

- ◆ Process chemicals
- ◆ Ancillary lubricants inadvertently introduced
- ◆ Metal & alloy fines from machining
- ◆ Water & cleaning agents using during routine housekeeping
- ◆ Biocides added to water-based MWFs for fluid management
- ◆ Microorganisms & microbial byproducts in water-based MWFs
- ◆ Other environmental processes in the plant



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What Are Metalworking Fluids? Routes of Exposure

When a worker machines, i.e., grinds, turns, taps, rolls or drills a piece of metal, both the tool and the metal work piece can become extremely hot due to friction. Fluids are used to reduce the friction, and thereby prolong the life of the tool, protect the surface of the work piece, and carry away debris and generated heat. **These fluids are called metalworking fluids (MWFs), metal removal fluids (MRFs) machining fluids, cutting oils, or coolants.**



◆ Inhalation

During machining, a fine mist is generated when the MWF is used during machining operations. Workers may inhale this aerosol.

◆ Dermal Contact

Workers also get MWFs on their skin during machining, and when handling and cleaning the machined metal pieces.

Health Effects

Lung Disease

Exposure to oil mists and MWFs in particular has been linked to asthma, chronic bronchitis, acute airway irritation, lipid pneumonia, and hypersensitivity pneumonitis (HP). Pre- and post-shift spirometry often shows a decline in pulmonary function by the end of the day. Studies show that exposure can cause an adverse chronic effect.

Outbreaks of HP have been recorded due to exposure to various MWFs that are either water-based, or diluted with large amounts of water, at concentrations above and below the National Institute of Occupational Safety & Health (NIOSH) recommended exposure limits (RELs). Current thinking is that microbial contaminants in the MWFs are the culprits. A specific organism has not been identified, although several are presently being studied as possible causative agents.

Some workers with HP have been able to return to jobs where no MWFs or different MWFs are used. In addition to lowering the concentration of MWF aerosol exposure, careful maintenance of the metalworking fluids themselves is *essential*.

Types of Metalworking Fluids

MWFs are grouped into four classes:

1. **Straight Oils (Neat Oil)**
2. **Soluble Oils (Emulsified Oil)**
3. **Semi-synthetic MWFs**
4. **Synthetic MWFs**

Some of these MWFs are used full strength, while others are designed to be diluted with water. There are many different additives commonly included in the formulation of each type to make them last longer and improve properties, such as ability to withstand high temperature and pressure, inhibit rust, and kill microorganisms that accumulate in the MWF sumps, etc.

MWFs can become contaminated with metal fines, microbes and their toxic breakdown products, and tramp oils.





MWF dermatitis can be painful and disabling.

Who Is At Risk?

Anyone who machines metal parts is at risk of exposure to MWFs. Some typical activities they may be engaged in include:

- ◆ Cleaning machined parts
- ◆ Cutting, punching, press machine operations
- ◆ Deburring
- ◆ Drilling & boring
- ◆ Extruding & drawing machine operations
- ◆ Forging machine operations
- ◆ Gear cutting
- ◆ Grinding, filing, sharpening, polishing, buffing
- ◆ Milling & planing
- ◆ Turning & lathe work



Health Effects, cont.

Dermatitis

Skin diseases are extremely common in workers exposed to MWFs. These diseases can be prevented by using engineering controls, wearing personal protective equipment, and substituting less irritating additives or MWF constituents.

Typically, folliculitis, oil acne, and keratoses are associated with exposure to straight MWFs, while cases of irritant contact dermatitis, and less frequently, allergic contact dermatitis are linked to soluble, semisynthetic and synthetic MWFs. Many workers continue to work with skin lesions causing severe itching and burning. They often become disabled as a result of these skin diseases.

Cancer

There is substantial evidence supporting an association between some MWFs and increased risk of cancer of the larynx, rectum, pancreas, skin, scrotum, and bladder. Studies have demonstrated that there is up to a 20 year latency period, indicating exposures in the mid-1970's and earlier. However, these studies showed poor consistency between specific types of cancer associated with MWFs. The specific MWF constituents were not determined. This is probably due to the diversity in MWF formulations studied.

It is noteworthy that there have been significant changes in the metalworking industry over the past several decades. Some of the changes include new formulations for MWFs, use of severely refined base oils, elimination of nitrites, and newer additives. Some facilities now use skimmers and filtration systems to remove impurities resulting from machining processes. Therefore, the carcinogenic potential from exposure to MWFs today remains undetermined.

Note to Patients

Be sure to tell your doctor what types of materials and chemicals you work with or are exposed to at your job. Pay attention to any patterns of illness that you might experience. An example would be feeling worse at work, but better when away from work (i.e., nights, weekends), or visa versa. You may notice needing to use your inhaler more when certain types of activities or processes are going on at work. Report these patterns to your doctor.

Note to Physicians

Taking an occupational history may aid in diagnosing your patient. The Connecticut Department of Public Health has a video tape and accompanying booklet entitled, *The Exposure History: A Key To Better Care Of Your Patients*. Call 860-509-7744 for a copy.

The Agency For Toxic Substances and Disease Registry (ATSDR) also publishes an excellent series called *Case Studies in Environmental Medicine*. Their booklet, *Taking An Exposure History*, may be obtained from the ATSDR website: <http://www.atsdr.cdc.gov/HEC/CSEM/exphistory/index.html>

References

1. *What You Need to Know About Occupational Exposures to Metalworking Fluids*. US Dept. Health & Human Services, Centers for Disease Control & Prevention, National Institute for Occupational Safety and Health. March 1998.
2. *NIOSH Criteria for a Recommended Standard. Occupational Exposure to Metalworking Fluids*. US Dept. Health & Human Services, Centers for Disease Control & Prevention, National Institute for Occupational Safety and Health. January 1998.