

Metalworking Fluids: A Fact Sheet for Workers

What are Metalworking Fluids?

Metalworking fluids (MWFs) are also known as coolants, cutting oils, lubricants, and machining fluids. MWFs are used to cool and lubricate metalworking processes. MWFs are specifically designed for a variety of metalworking operations, such as turning, grinding, boring, drawing, tapping, gear shaping, reaming, rolling, hobbing, and band- and hack-sawing.



Who is Exposed to MWFs?

According to the National Institute for Occupational Safety and Health (NIOSH), over 1 million workers in the United States are exposed to MWFs. Here at the Safety & Health Assessment & Research for Prevention (SHARP) program, we have estimated that approximately 20,000 workers in Washington State use MWFs. While machinists, machinery mechanics, metalworkers, and other machine operators and setters have the greatest contact with MWFs, workers performing assembly operations can also be exposed if MWFs remain on the machined product. Workers can be exposed to MWFs by skin contact, or by inhaling (breathing in) or ingesting (swallowing) particles, mists, and aerosols.

What are MWFs' Health Effects?

Although recent changes in MWF formulations have resulted in safer products, it is important to realize that MWFs can still contain substances that are harmful to your health. The most commonly observed illnesses associated with MWF use are:

Skin Problems. Skin contact with MWFs is very common, since MWFs are often applied to the machine tool in large volumes. Workers' skin can be covered with mist or spray while machining, or handling parts and tools covered with residual fluid. MWF-soaked rags and clothing can prolong the length of time that the MWF is in contact with the skin. MWFs have been shown to cause numerous skin problems, ranging from dermatitis due to irritation or allergy (very common) to skin cancer (relatively rare). NIOSH has observed that between 14% and 67% of workers using MWFs have dermatitis.

Cancer. There is evidence to suggest that exposures to some MWFs can increase workers' risk for cancer of the skin, esophagus, stomach, pancreas, larynx, colon, rectum, and other organs. However, the link between MWF exposure and cancer is controversial, since the epidemiological studies were performed on workers who were exposed to MWFs as long as 20-30 years ago. Before the 1950s and 1960s, some MWFs contained relatively high concentrations of substances suspected to cause cancer (mostly polycyclic aromatic hydrocarbons and nitrosamines). Since then, industry actions have resulted in substantially reduced concentrations of these substances in MWFs. However, it is unclear whether these changes have eliminated the cancer risk because it is not known if the cancer-causing substances are present in the MWFs themselves, or whether they are constituents of MWF additives or contaminants.

Lung Disease. Inhaling the aerosols, particles, and mists generated by MWFs while machining is a common source of exposure. Several lung diseases

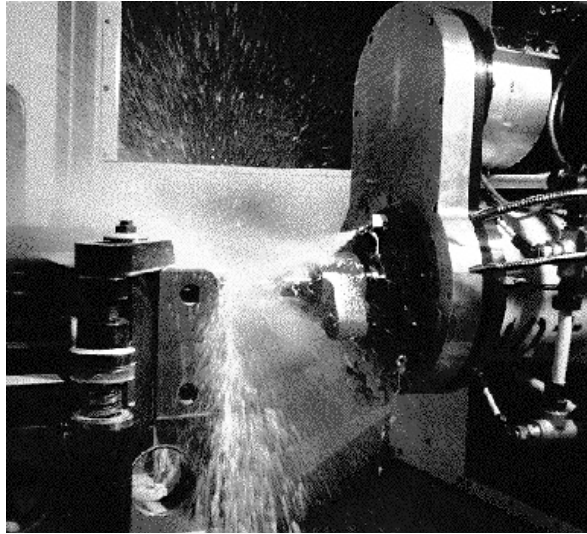
Machinists and other workers who handle metalworking fluids can protect themselves from potentially serious health effects associated with these widely-used substances. This fact sheet explains how.

are associated with inhaling MWFs, including asthma, acute airway irritation, hypersensitivity pneumonitis, lipid pneumonia, chronic bronchitis, and possibly lung cancer. NIOSH researchers suggest that machinists face an increased risk of asthma at concentrations below the current permissible exposure limits (PELs).

MWFs can contain a variety of substances that are harmful to your health. Some of these substances are present in the original MWF formulation, some are additives that are used to control the growth of microorganisms or prevent corrosion, and others are contaminants that are introduced into the MWF while it is being used.

Examples of potentially harmful substances that are present in “off-the-shelf” MWFs and additives include certain mineral oils, triethanolamine, biocides, and chlorinated paraffins.

Substances that can contaminate MWFs include microorganisms (bacteria and fungi) and their toxins, polycyclic aromatic hydrocarbons, nitrosamines, and metals.



What Occupational Standards Apply to MWFs?

The two most important occupational standards that apply to MWFs are those for “particulates not otherwise regulated” and “oil mists”.

In Washington State, the PEL for “total” particulates is 10 milligrams of total particulate per cubic meter of air (10 mg/m^3), based on an 8-hour time weighted average (TWA). This means that exposures to total particulates can legally exceed 10 mg/m^3 at times, but only if concentrations are below 10 mg/m^3 at other times, so that the *average* exposure for any 8-hour workshift is 10 mg/m^3 or less. The PEL for oil mists is an 8-hour TWA of 5 mg/m^3 .

NIOSH is concerned that workers may experience adverse respiratory effects if they are exposed at the current PELs. NIOSH recommends that occupational safety and health programs that include medical monitoring should be established at MWF-using workplaces. As of summer 1997, NIOSH is finalizing its “Criteria Document” (see sidebars on page 3) and OSHA (the Occupational Safety and Health Administration) is convening a committee of national experts to develop a proposal for a new standard to lower workplace exposures and increase worker protection.

PELs also exist for certain additives and other MWF constituents.

Making Changes at Work: Protecting Yourself and Your Co-Workers

The following steps can help you and your co-workers reduce your exposures to the harmful constituents found in some MWFs:

✓ Find out what type of MWF you use:

Your fellow workers should know about the hazards associated with using MWFs. Give them a copy of this fact sheet and encourage them to contact management and/or SHARP with any questions or concerns.

Check the labels on the MWFs that you use, so that you know what type(s) you are exposed to.

Read the MSDSs (Material Safety Data Sheets), so that you know the ingredients of the MWFs and are aware of the potential health effects associated with your MWF.

Find out what additives are used in your MWFs. These additives are used to control rust, prevent the growth of bacteria and fungi, reduce foaming, etc.

Find out if the additives are nitrites or ethanolamine-type chemicals. These additives may produce nitrosamines, which have been shown to cause cancer in laboratory animals.

Find out whether the metal you are working with is coated or treated with nitrite-containing rust inhibitors. Nitrosamines can be formed if your MWF contains ethanolamine and the metal you are working on is coated with a nitrite-containing rust inhibitor.

✓ Pay attention to your MWFs:

Replace MWFs that begin to smell worse than usual. This probably means that high levels of microorganisms (bacteria and fungi) are growing in the system. Thoroughly clean and flush the system before adding fresh fluids, otherwise the new MWF will be quickly re-contaminated. Microorganisms and the toxins they sometimes produce can be harmful to your health.

Be aware of color changes in your MWFs. Change your MWFs if they become irritating to your skin, nose, or lungs.

If possible, keep the MWF circulation system running, even if the machine is not being used. This

keeps the MWFs aerated, preventing the growth of foul-smelling bacteria in stagnant MWFs.

Avoid introducing foreign materials into the MWF circulation system. Cigarette butts, food, spit, and other contaminants degrade MWFs' performance and encourage the growth of bacteria and fungi.

Check whether "tramp oil" is contaminating your MWFs. Leaking greases, oils, and hydraulic fluids can degrade MWF performance, introduce harmful chemicals, and encourage the growth of bacteria and fungi.

Maintain the MWFs at the pH and concentration range recommended by the supplier. The MWF temperature should be maintained as low as possible to slow the growth of bacteria and fungi.

If you are machining tungsten carbide, change the MWF more frequently than you would if machining less toxic materials. This prevents the build-up of cobalt, which can cause a lung disease called "hard metal disease."

✓ **Other personal protective measures:**

Where practical, reduce your exposure by using gloves, protective clothing (coveralls, aprons), and safety glasses. If the machined material is toxic or the PEL cannot be achieved, it may be necessary to wear a respirator. The type of respirator should be appropriate for the type of operation, nature of the chemical hazard, and the airborne concentration in your breathing zone. Respirators should be used in conjunction with your employer's respiratory protection program.

Change your clothing if it becomes soaked with MWFs, and don't keep MWF-soaked rags in your pockets.

Apply MWFs at the lowest possible pressures and flow volumes at the tool/workpiece interface. This will reduce the amount of mist generated.

If available, use splash guards to reduce the amount of spray coming off the tool.

Avoid using compressed air to clean off residual MWFs. If you have to use compressed air, try to direct the airflow away from your breathing zone.

Wash your hands with **mild** soap and water and dry them with **clean** towels. Avoid using harsh detergents and never use solvents to clean your hands. Applying barrier creams **before** working with MWFs may help

to reduce skin problems.

Keep personal items such as food, drinks, cosmetics, and tobacco away from your work environment. Don't eat, smoke, or apply cosmetics in MWF areas to prevent additional MWF exposure.

✓ **Other ideas and changes for you to consider:**

A health and safety program is required in all Washington State workplaces. Health and Safety Committees are required at workplaces with more than 10 employees.

Establish a MWF management program, and nominate individuals to take responsibility for MWF quality.

Encourage your employer to adopt NIOSH's recommendations before a new exposure limit becomes law.

Are machining operations that use high volumes of MWFs enclosed? If not, discuss whether retrofitted enclosure systems could be installed.

Check your local exhaust ventilation. The ventilation should be installed directly on the machine, so you don't breathe in the MWF mist. General ventilation on the ceiling may not be sufficient.

Consider using MWFs that contain pure mineral oil or vegetable oil. These oils are less toxic than the cruder oils used in some MWF formulations.

Have your workplace air monitored by an industrial hygienist—to determine the concentration of particulates and/or oil mist in your breathing zone.

Develop an industrial hygiene air sampling plan—to regularly monitor particulate and/or oil mist levels.

Order a copy of NIOSH's "Criteria Document". Since NIOSH's recommendations concerning establishment of health & safety programs may become law, encourage your employer to consider what steps could be taken now to comply with these recommendations.

There are several very simple steps that you can take to reduce your exposure to MWFs - from not eating or drinking in your work area to wearing appropriate protective clothing and using splashguards and other engineering controls.

The final version of the NIOSH's "Criteria for A Recommended Standard: Occupational Exposures to Metalworking Fluids" will be released by Fall 1997. To request a copy, call 1-800-35-NIOSH.

What is SHARP?

SHARP is a multidisciplinary research group within the Washington State Department of Labor & Industries, whose mission is to conduct research, monitoring, and demonstration projects that promote healthy work environments and the prevention of workplace injuries and illnesses.

If you have any questions about MWFs, or any other workplace health and safety concerns in Washington State, please contact us at:

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 PO Box 44330
 Olympia WA 98504-4330
 Ph. (888)-66-SHARP (toll-free)
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This fact sheet is also available on SHARP's World Wide Web site:

<http://www.wa.gov/lni/sharp/>

SHARP is conducting several studies into MWF use and exposures in Washington State. If you would like to participate in a study, please contact us at the address shown above.

ACKNOWLEDGEMENTS

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