



# Loss Control TIPS

## Technical Information Paper Series

*Innovative Safety and Health Solutions<sup>SM</sup>*

---

## Working Safely With Metalworking Fluids

Metalworking Fluids (MWFs), also called Metal Removal Fluids (MRFs), are complex fluid systems designed to cool machine tools and remove debris from the point of operation. These fluids are blends of water, oils (including straight oils, soluble oils, synthetics and semi-synthetics), emulsifiers, defoaming agents, biocides, and other chemicals. They also routinely contain dirt, metal fines, and microbiologicals. They are so complex that the chemistry found in the sump of one machine will not be identical to that found in any other piece of equipment.

It's easy to understand that the health effects from exposure to MWFs may also be complex. While the toxicology of these substances is not fully understood, and the chemistry of MWFs has changed over time, these health effects are reported:

1. Exposure has been "closely associated" with cancers of the stomach, pancreas, larynx, colon, rectum, and other organs.
2. Respiratory effects, including irritation, bronchitis, hypersensitivity pneumonitis, occupational asthma, and acute loss of lung function have been noted. The offending agents which cause these respiratory effects include mists of the MWF, chemical additives, contaminants (including so-called "tramp" oils), and microorganisms.
3. The most frequently reported health effects from exposure to MWFs are those involving the skin, including irritation, contact dermatitis, and allergic contact dermatitis.

Acting on a 1993 petition from the United Auto Workers and subsequent recommendations from the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA) convened a Standards Advisory Board to study the issue and to evaluate existing regulations. The board's recent findings and recommendations to OSHA may become the basis for OSHA rulemaking in the near future.

However, because of the significance of the board's findings and the health effects of MWFs noted above, The Hartford encourages employers to become pro-active and take the necessary steps to ensure their employees' health.

This document is intended to offer guidance on the control of employee exposure to metalworking fluids. While it generally follows the NIOSH criteria document and the recommendations of the Standards Advisory Board, no assurance can be given that this document contains all aspects of the anticipated OSHA standard, or of any other existing rule or regulation.



## Preventing Respiratory Effects

The NIOSH Criteria Document and the recommendation of the OSHA Standards Advisory Board establish an eight-hour exposure limit of 0.5 Mg/M<sup>3</sup> for metalworking fluids. Ensure that employee exposure is *lower* than this limit in all operations.

Follow these basic steps to reduce the possibility that an exposed employee might develop respiratory problems:

- Reduce fluid delivery pressures to the lowest pressure possible consistent with desired effects.
- Avoid delivery of the MWF on rotating parts other than at the tool/workpiece interface.
- When machining is not in progress, cease delivery of the fluid to the machine.
- Install engineered mist collectors appropriate to the operation, and avoid re-circulation of contaminants into other areas.
- Monitor and prevent microbiological growth in the fluid.

## Preventing Dermal (Skin) Effects

Many factors contribute to skin problems among employees who work with MWFs, including:

- The type of fluid and additives in use
- The machine type and mist control systems in use
- The presence of skin abrasions and/or cuts
- Inadequate personal hygiene
- Use of contaminated clothing
- Degree of workplace cleanliness and climate
- Individual susceptibility

To reduce the risk that an employee will experience skin problems during work with metalworking fluids, follow these guidelines:

- Use less irritating fluids and additives.
- Isolate the machining process, modify it, or automate it.
- Improve work practices and personal hygiene standards.
- Use proper personal protective equipment.
- Train employees to avoid wetting their clothing with MWFs, and to change clothing that becomes wet.
- Train workers in safe use of metalworking fluids.

## Reducing Overall Exposure

As is true with all occupational health issues, employers can take basic steps to reduce risk and to lower the likelihood of adverse health effects from industrial materials. For operations where metalworking fluids are used, consider the following guidelines:

### Train Exposed Employees

Give employees who work with metalworking fluids comprehensive Hazard Communication training specific to metalworking fluids. In particular, train employees to recognize bacterial overgrowth and fluid degradation, and train them in safe work practices and appropriate personal hygiene.

## **Conduct a Worksite Analysis**

Use competent personnel (or engage consultants) to conduct industrial hygiene monitoring to quantify the extent of exposure in your operations. Re-evaluate exposures if initial monitoring indicated greater than 50% of the exposure limit; also re-evaluate exposures if significant operational changes occur.

## **Ensure Proper Fluid Maintenance**

First of all, work with your engineering staff and your MWF supplier to ensure that the correct fluid has been selected for each operation. Establish formal procedures for appropriate fluid maintenance, including frequent fluid analysis (check concentration and pH daily; check for biological contamination weekly). Train your staff on how to take these measurements, and contract with a qualified laboratory for those that your staff can't do. Take steps to minimize the introduction of contaminants (e.g., cigarette butts, floor sweepings, etc.) and 'tramp' oils (e.g., way oils and other lubricants) into the MWF. Establish preventative (not remedial) use of biocides. Make sure that only authorized employees introduce additives to the metalworking fluid. Prohibit the use of odorants to mask unwanted odors; unpleasant odors indicate that something is wrong in the system. Rather than masking the odor, take steps to identify and correct the problem.

## **Maintain Fluid Delivery Systems**

Prevent the introduction of contaminants by covering sumps and tanks and by guarding return trenches. Make sure that the appropriate filters are installed and maintained. Keep the machines and the delivery systems clean and free of debris.

## **Provide Ventilation**

Enclosures to the equipment and process can be effective barriers to the escape of fluid mists. Enclosures that are part of the original equipment, as well as specifically engineered enclosures, offer superior performance to generic add-ons. Engineer ventilation systems to accept fluid mists and to keep them suspended until they are exhausted away from the worksite. Make sure that ventilation systems don't capture the contaminant and introduce it into another area.

## **Improve Personal Hygiene and Sanitation**

Whenever clothing becomes wet with MWFs, it should be removed immediately and laundered. Exposed skin should be washed with mild soap and water before lunch, restroom, or exiting the plant. Establish a firm "No Smoking" policy for manufacturing areas where metalworking fluids are used. Keep floors, work areas, and machines clean as a matter of course.

## **Monitor the Health of Exposed Employees**

Conduct pre-placement physical exams for all new hires. These physicals should include a medical history, baseline spirometry, and an evaluation of skin condition. Conduct periodic (annual) exams, and conduct exams whenever employees present complaints or concerns, or when they exhibit symptoms.

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford's Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

*This document is provided for information purposes only. It is not intended to be a substitute for individual legal counsel or advice on issues discussed within. Readers seeking resolution of specific legal issues or business concerns related to the captioned topic should consult their attorneys and/or insurance representatives.*

# Metal Removal Fluid (MRF) System Management Checklist

<b>Plant:</b>	<b>Operation:</b>
<b>Department:</b>	<b>Bay/Column:</b>
<b>Date:</b>	<b>Completed by:</b>

Instructions: Place a check in the appropriate boxes below. If "No" is checked, make comments and recommend corrective actions if possible. If an item does not apply to the plant/department/ operation, check the "NA" box. Detail corrective actions or comments in the space provided.

<b>Hazard Communication</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Are the metal removal fluids currently being used according to the Safe Use Instructions and Material Safety Data Sheet?				
2. Are metal removal fluid containers labeled properly and are employees using product as per the label?				
3. Is hard piping that contains MRF properly labeled?				
4. Are employees using required personal protective equipment (e.g. safety glasses, gloves, respirators, etc.)?				
5. Are metal removal fluid containers being stored according to specification contained in the MSDS?				
6. Have employees been trained on the MRF and applicable additives used on their job?				
<b>Housekeeping</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Are walking surfaces free of metal removal fluids or other machine fluids (e.g. hydraulic oil) that may be potential slip hazards?				
2. Are machines washed down and cleaned regularly to prevent stagnation of MRFs?				
3. Are drip pans, trenches and the surrounding floor free of cigarette butts, cups or other trash?				
4. Are drip pans and other fluid reservoirs in good condition and cleaned regularly to avoid stagnation?				
5. Are MRF and oil spills or leaks cleaned up promptly?				
6. If "Floor Dry" or absorbent socks are used around machines to control continuous leaks or splashing, have work orders been submitted for repairs?				
7. Are machine interiors, exteriors and the surrounding floor free of chip accumulations that can interfere with proper MRF circulation?				
8. Are building structures (e.g., trusses, columns or pipes) free of dripping MRF?				



## Metal Removal Fluid (MRF) System Management Checklist, page 2

<b>Ventilation and Exposure Control</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Are exhaust ventilation hoods in good condition?				
2. Does local exhaust ventilation adequately capture MRF aerosol?				
3. Are man-cooling fans, if present, placed or directed so as not to interfere with the exhaust ventilation?				
4. Are supply air diffusers and supply air ductwork in good condition and operating properly?				
5. Do mist collector pressure gauge (e.g. Magnehelic) readings fall within the specified range?				
6. Are mist collector(s) and ductwork free of any visible emissions?				
7. Is a record of mist collector maintenance (e.g., filter changes) attached to the collector(s)?				
8. Is the flow of MRF at each operation interrupted or cycled off when machining or grinding is not occurring?				
9. Is MRF delivered directly to the cutting zone and fluid pressure reduced to the minimum required?				
10. Are coolant sumps covered with solid material or a moderate foam blanket to contain a mist?				
11. Is ambient MRF aerosol routinely monitored to ensure employee exposures do not exceed 2.0 mg/m <sup>3</sup> ?				
12. If employee exposures exceed 2.0 mg/m <sup>3</sup> , have equipment repairs or other corrective actions been implemented?				
13. Is new machinery designed and tested to ensure MRF aerosol emissions do not exceed 1.0 mg/m <sup>3</sup> ?				
<b>Machine Guarding</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Are machine guards in place and in good condition?				
2. Does guarding contain splashing and prevent visible aerosol emissions?				
3. Where necessary, are there provisions for mist containment at each machining station?				
<b>MRF System Monitoring and Maintenance</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Are MRF management responsibilities and testing protocols specified in a written plan?				
2. Are coolant systems routinely monitored for MRF concentration, pH, microbial levels, tramp oil, suspended particulate, etc.?				
3. Are fluid system additions controlled by the MRF Coordinator /Manager, recorded on a log sheet, and performed "off-shift" when the plant population is reduced?				
4. Are system clean-outs routinely scheduled? Do they follow standard operating procedures?				
5. Are systems thoroughly cleaned (e.g. power washing and rinsing) before recharging with fresh fluid?				

The Checklist Copyright © 1999 Organization Resources Counselors  
 Used with permission. All rights reserved. Revised: January 10, 2000  
 Prepared by AWARE Services

# Metal Removal Fluid (MRF) System Self-Assessment Checklist

<b>Plant:</b>	<b>Operation:</b>
<b>Department:</b>	<b>Bay/Column:</b>
<b>Date:</b>	<b>Completed by:</b>

Instructions: Place a check in the appropriate boxes below. If "No" is checked, make comments and recommend corrective actions if possible. If an item does not apply to the plant/department/ operation, check the "NA" box. Detail corrective actions or comments in the space provided.

<b>Fluid Selection</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Have I selected a metal removal fluid supplier that can provide the products and level of support that I need?				
2. Have I selected a metal removal fluid most appropriate for the operations intended?				
3. Have I reviewed the metal removal fluid's MSDS and do I understand the acute toxicity characteristics and chronic toxicity characteristics, if any?				
4. Have I selected a fluid that minimizes components which may be irritating or which may produce objectionable odors, such as some alkanolamines, some short-chain organic acids, and some high volatility petroleum oils?				
5. Have I selected a MRF with an understanding of the fluid's misting characteristics?				
6. Have I evaluated the chemicals likely to be added to the MRF for compatibility?				
7. Have I considered the residue characteristics and corrosion-resistance characteristics of the MRF selected and is the MRF after water has been evaporated soluble or dispersible in the lubricants used on the machine tools?				
8. Have I evaluated the emulsifiability of the lubricating oils and hydraulic fluids in the MRF?				
9. Have I evaluated the galvanic corrosion properties of the MRF if copper, aluminum and/or zinc metals may come in contact with both steel, each other and the MRF?				
10. Have I evaluated the compatibility of the MRF with all system components that may come into contact with it such as valve seats, elastomers and seal material?				
11. Have I evaluated the filterability of the MRF to be sure it functions effectively with the particular filtration equipment in use?				

<b>Fluid Management</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Have I established a (written) metal removal fluid management program ("MRFP") appropriate to size of system(s) and sump(s) that includes management and employee responsibilities and record keeping?				
2. Does the MRFP include a statement of goals and commitment?				
3. Does the MRFP designate an individual or team with overall responsibility for the program?				
4. Does the MRFP designate an individual or team responsible for adding materials to the system?				
5. Does the MRFP include procedures for sampling, testing and evaluating the fluid?				
6. Does the MRFP include a data collection and tracking system?				
7. Does the MRFP include participation of employees who work with the system everyday?				
8. Does the MRFP include a training program?				
9. Have I established as part of my MRFP a monitoring program for MRF microbiology and control?				
10. Have I established as part of my MRFP appropriate instructions for handling, storage and use of each anti microbial or biocide as established by the biocide manufacturer?				
11. Have I controlled the MRF concentration?				
12. Have I maintained the pH of my water-based MRF				
13. Have I removed physical and chemical contaminants from the fluid?				
14. Have I minimized contamination of the MRF by carryover from prior processes?				
15. Have I minimized contamination of the MRF by floor cleaners, solvents, and trash?				
16. Have I evaluated the metal removal performance of the MRF?				
17. Do I have a process in place where metal removal fluid operations include regular checks to detect leaks and spills?				
18. Have I made provisions to properly and promptly contain and clean up spills of in-use or as-received MRFs and made provisions to dispose of waste and debris in accordance with applicable regulations?				
19. Is tramp oil contamination of the MRF minimized, and, if present, is the tramp oil routinely removed from the system?				

20. Have I evaluated the waste treatability of the MRF and additives to assure that they function appropriately in the waste treatment process used at my facility?				
<b>Facilities and Equipment</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Has each workplace location been evaluated with respect to the number of machine tools in a given area, the types of operations performed, existing ventilation patterns, ceiling height and ultimate disposition of collected mist?				
2. Are my metal removal fluid delivery systems designed to minimize generation of MRF aerosols?				
3. Are fluid flows designed to minimize splashing, but high enough to prevent formation of smoke?				
4. Is the minimum adequate fluid pressure used?				
5. Are MRF delivery system components, including pumps and seals, properly maintained to minimize leaks that entrain air into the MRF?				
6. Are flumes and other sources of aerosol generation covered and vented to the MRF reservoir or maintained under negative pressure?				
7. Does the MRF sump have a foam blanket that can act as a trap to capture MRF mist released from bursting bubbles of entrained air?				
8. Have new machine tools been selected with appropriate enclosures and ventilation that minimizes release of the MRF aerosol into the workplace atmosphere?				
9. Has the machine tool MRF delivery system been designed so that the flow of MRF to the machine tool is interrupted when actual machining or grinding is not occurring?				
10. Are existing equipment enclosures and guarding maintained to minimize release of aerosol?				
11. Has retrofitting of older equipment using ANSI Technical Report B11 TR 2-1997 as a guide been considered?				
12. Is exhaust ductwork from machine tool enclosures designed and maintained in accordance with ANSI B 11 TR 2-1997 as a guide?				
13. Is exhaust ductwork inspected and cleaned regularly and ductwork not in good working order repaired?				
14. Are mist collectors properly designed and maintained using ANSI B 11 TR 2-1997 as a guide?				
15. Are air cleaner filters regularly cleaned or replaced as appropriate and is collected aerosol prevented from draining back into the system?				



16. Is airflow of local exhaust ventilation systems periodically measured to ensure proper system performance?				
17. If recirculation of exhaust air is used, is air adequately cleaned of contaminants prior to being recirculated?				
18. Has installation of remote control panels for machine tools been considered as an approach to reduce employee aerosol exposure?				
<b>Employees</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
<b><i>Training</i></b>				
1. Have I established an employee training program to ensure that workers understand workplace hazards and safe operating procedures in order to do their job safely?				
2. Have I made available specific information from material safety data sheets for metal removal fluids and additives to employees as part of my written Hazard Communication program as required by OSHA 29 CFR 1910.1200?				
<b><i>General Considerations</i></b>				
1. Do employees wash hands with mild soap and warm water before breaks and meals?				
2. Do employees avoid using rags contaminated with metallic debris such as swarf and chips?				
3. Do employees change work clothing if it becomes soaked with metal removal fluids during the work shift?				
<b><i>Medical Management</i></b>				
1. Have I made medical monitoring available to employees prior to assignment to a job working with metal removal fluids?				
2. Have I instituted a medical management program for all employees who report signs or symptoms of respiratory or derma conditions associated with metal removal fluid exposure?				
3. If employees have reported signs or symptoms of respiratory distress or dermatitis associated with metal removal fluid exposure, have I attempted to identify the root cause and control the hazard?				
<b><i>Hazard Control</i></b>				
1. Have I evaluated the need for, and, as appropriate, developed and implemented a plan to reduce employee dermal and respiratory exposures or other workplace hazards?				
2. If so, does the plan to reduce employee exposure include:				
A description of how the exposure is to be reduced or how the fluid management issue is to be				

otherwise addressed, including a timetable for implementation?				
Institution of engineering and work practice controls to educe and maintain employee exposure levels to below applicable limits before requiring the use of respiratory protection or other persona; protective equipment?				
Does the exposure reduction program include the following core elements: management leadership and employee participation; hazard assessment; hazard prevention and control; training; and, evaluation of program effectiveness?				
Have responsibilities for the Employer Health and Safety Program for employees who work in the metal removal fluid environment been established for managers and supervisors?				
Have opportunities been provided for meaningful, effective communication between employers and employee about occupational safety and health matters regarding exposure to metal removal fluids and contaminants, including reporting of job-related injuries and illnesses?				
<b><i>Dermatitis</i></b>				
1. Have employees who work with MRFs reported signs or symptoms of occupational dermatitis?				
2. If so, have the employees with dermatitis sought medical attention?				
3. Have I attempted to identify the root cause and control the dermatitis?				
4. Have I considered all of the following factors as I have attempted to identify the root cause:				
Is the employee allergic to the MRF, its components such as some biocides or odorants or contaminants such as dissolved or suspended chromium, cobalt or nickel?				
Has the employee been dermally exposed to MRF concentrates?				
Has the employee been dermally exposed to higher-than-recommended in-use MRF concentrations?				
Has the employee been dermally exposed to sources of high alkalinity, such as alkaline cleaners?				
Has the employee been dermally exposed to solvents or other materials that defat the skin?				
Has the employee been dermally exposed to metal shavings or fines contained in the fluid from a malfunctioning filter or from dirty shop rags?				
Has the employee been washing his or her hands with abrasive soaps?				



Are there environmental factors, such as dry air, extreme cold or changing humidity that might make dermatitis more likely?				
Could off-work activities be responsible for, or an aggravating factor in, the dermatitis?				
Is bacteria in water-containing MRFs a cause of secondary infections of the skin?				
5. Have I considered all of the following steps to prevent dermatitis?				
controlling MRF concentration and contamination?				
proper care and maintenance of the MRF system?				
avoiding prolonged skin contact with the MRF, fluid residues, soiled rags and clothing?				
washing the skin with warm water and a mild hand cleaner and gently but thoroughly drying prior to each break and before eating?				
use of barrier creams?				
proper care of the skin at home or off work?				
the use of gloves impervious to the MRF where rotating or moving machine tool parts are not a safety hazard.				
<b><i>Respiratory Effects</i></b>				
1. Have employees reported signs or symptoms of respiratory distress or dermatitis associated with exposure to metal removal fluids within the last year?				
2. If so, have the employees who reported the signs or symptoms sought medical attention?				
3. If employees have reported signs or symptoms of respiratory distress associated with exposure to metal removal fluids within the last year, have I conducted an assessment to determine exposure conditions?				
Have I walked the shop to determine areas of high exposure?				
Have I used a direct reading instrument to estimate average, short term or peak exposures?				
Have I reported the results of employee exposure monitoring to the affected employees?				
Have I instituted engineering and work practice controls, as necessary, to reduce employee aerosol exposures to metal removal fluids before requiring the use of respirators?				
4. If respiratory protection is provided, has the OSHA Respiratory Protection Standard (29 CFR 1910.134) been complied with?				

<i>Personal Protective Equipment</i>				
1. Do employees working in close proximity to operating metal removal processes or who transfer as-received fluids and ancillary materials wear eye protection as specified?				
2. As appropriate, do employees working in areas where metal removal operations occur wear other personal protective equipment as specified?				
<b>Management Program and Quality Assurance</b>	<b>Yes</b>	<b>No</b>	<b>NA</b>	<b>Corrective Action or Comment</b>
1. Have I set up an Employer Health and Safety Program for employees who work in the metal removal fluid environment that is appropriate to the conditions in the workplace?				
2. Does the employer's health and safety program provide for systematic, periodic identification of hazards related to employee exposure to metal removal fluids?				
3. Does the employer's health and safety program document hazard assessment and control activities related to employee exposures to metal removal fluids?				
4. Is the employer's health and safety program periodically evaluated to ensure that it is effective and appropriate to workplace conditions and revised, if necessary, to correct any deficiencies revealed by the evaluation?				
5. Do I maintain records of objective data which shows signs or symptoms of respiratory or dermal conditions associated with metal removal fluid exposure?				
6. Are records maintained in accordance with the requirements of OSHA 29 CFR 1910.1020?				
7. Do I maintain MRF management records?				
8. Do I review the collected information periodically to help make improvements in my plant?				

The Checklist Copyright © 1999 Organization Resources Counselors  
Used with permission. All rights reserved. Revised: January 10, 2000  
Prepared by AWARE Services

