



Standard Practice for Safe Use of Water-Miscible Metal Removal Fluids¹

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1. Scope

1.1 This practice sets forth guidelines for the safe use of metal removal fluids, additives, and antimicrobials. This includes product selection, storage, dispensing, and maintenance.

1.2 Water-miscible metal removal fluids are typically used at high dilution and dilution rates vary widely. Additionally, there is potential for exposure to undiluted metal removal fluid as manufactured, as well as metal removal fluid additives and antimicrobials.

1.3 Straight oils generally consist of a severely solvent-refined or hydro-treated petroleum oil, a synthetic oil, or other oils of animal or vegetable origin. Straight oils are not intended to be diluted with water prior to use. Additives are often included in straight oil formulations.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- D 3946 Test Method for Evaluating the Bacterial Resistance of Water-Dilutable Metalworking Fluids²
- E 686 Test Method for Evaluation of Antimicrobial Agents in Aqueous Metalworking Fluids³
- E 1302 Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids⁴
- E 1542 Terminology Relating to Occupational Health and Safety⁴
- E 1972 Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment⁴
- PS 42 Provisional Test Method for Metal Removal Fluid Aerosol in Workplace Atmospheres⁵
- PS 94 Provisional Practice for Personal Sampling and

Analysis of Endotoxin in Metal Removal Fluid Aerosols in Workplace Atmospheres⁴

2.2 *OSHA Standards (Occupational Safety and Health Administration):*⁶

- 29 CFR 1910.1200 Hazard Communication
- 29 CFR 1910.133 Eye and Face Protection
- 29 CFR 1910.134 Respiratory Protection
- 29 CFR 1910.1048 Formaldehyde
- 29 CFR 1910 Appendix B to Subpart 1. Non-mandatory Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection

3. Terminology

3.1 For definitions and terms relating to this practice, refer to Terminology E 1542.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *contaminant, n*—substances contained in in-use metal removal fluids that are not part of the as-received fluid, such as abrasive particles, tramp oils, cleaners, dirt, metal fines and shavings, dissolved metal and hard water salts, bacteria, fungi, micro biological decay products, and waste.

3.2.2 *control, v*—to prevent, eliminate or reduce hazards related to use of metal removal fluids in metal removal processes and to provide appropriate supplemental and/or interim protection, as necessary, to employees.

3.2.3 *dermatitis, n*—an inflammatory response of the skin

3.2.3.1 *Discussion*—Dermatitis can result from a wide variety of sources and processes. The most common origins are irritant or allergic responses to a chemical or physical agent. Signs and symptoms that typify the initial onset of dermatitis include: erythema (redness); edema (swelling; pruritis (itching); and, vesiculation (pimple-like eruptions). In more severe cases, fissures (deep cracks) and ulcers (open sores) may develop. The condition is usually reversible when exposure to the causative agent ceases. More severe cases may require more time and some medical attention. Some individuals may be at higher risk.

3.2.4 *emergency, n*—any occurrence, such as but not limited to equipment failure, rupture of containers, or failure of control equipment that results in an uncontrolled release of a significant amount of metal removal fluid.

¹ This test method is under the jurisdiction of ASTM Committee E-34 on Occupational Health and Safety and is the direct responsibility of Subcommittee E34.50 on Health and Safety Standards for Metalworking Fluids.

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² *Annual Book of ASTM Standards*, Vol 05.02.

³ *Annual Book of ASTM Standards*, Vol 11.05.

⁴ *Annual Book of ASTM Standards*, Vol 11.03.

⁵ *Discontinued*, see 1998 *Annual Book of ASTM Standards*, Vol 11.03.

⁶ Code of Federal Regulations available from United States Government Printing Office, Washington, DC 20402.

3.2.5 *employee exposure, n*—the exposure to metal removal fluids and contaminants which would occur without corrections for protection provided by any respirator or other personal protective equipment that is in use.

3.2.6 *endotoxins, n*—a lipopolysaccharide derived from the outer membrane of Gram-negative bacteria.

3.2.7 *folliculitis, n*—an inflammatory reaction in hair follicles

3.2.8 *metal removal fluids, n*—the subset of metalworking fluids that are used for wet machining or grinding to produce the finished part.

3.2.8.1 *Discussion*—Metal removal fluids addressed by this practice include straight or neat oils, not intended for further dilution with water, and water-miscible soluble oils, semisynthetics, and synthetics, which are intended to be diluted with water before use. Metal removal fluids become contaminated during use in the workplace with a variety of workplace substances including, but not limited to, abrasive particles, tramp oils, cleaners, dirt, metal fines and shavings, dissolved metal and hard water salts, bacteria, fungi, microbiological decay products, and waste. These contaminants can cause changes in the lubricity and cooling ability of the metal removal fluid as well as have the potential to adversely affect the health and welfare of employees in contact with the contaminated metal removal fluid.

3.2.9 *metal removal process, n*—a manufacturing process that removes metal during shaping of a part, including machining processes, such as milling, drilling, turning, broaching, and tapping, and grinding processes, as well as honing and lapping, and other similar mechanical operations in which metal is removed to produce a finished part.

3.2.10 *tramp oil, n*—oil and oil-soluble additives, sometimes insoluble, resulting from leaking hydraulic, spindle, slide way, or gear oil into the metal removal fluid. Tramp oils may contaminate the metal removal fluid with components that are emulsifiable but which were not part of the metal removal fluid as formulated.

3.2.11 *wet metal removal fluid environment, n*—the workplace environment in which wet metal removal operations occur.

4. Significance and Use

4.1 Use of this practice will improve management and control of metal removal fluids. The proper management and use will reduce dermal and other occupational hazards associated with these fluids.

5. Routes of Metal Removal Fluid Exposure and Effects of Overexposure

5.1 Routes of exposure to metal removal fluids include eye contact, inhalation, ingestion, and dermal contact. Exposure may be through contact with the fluid or by contact with airborne fluid mists, vapor or fluid residue on machinery and on parts.

5.2 Eye contact may cause mild to severe irritation.

5.2.1 Prevent eye contact. Wear eye protection appropriate for the level of splashing or spraying encountered, such as safety glasses with side shields or goggles. See 29 CFR 1910.133.

5.3 Inhalation may cause respiratory irritation.

5.3.1 Minimize exposure to mists and vapors. Threshold limit values (American Conference of Governmental Industrial Hygienists) or permissible exposure levels (OSHA) of component ingredients shall not be exceeded. Engineering controls, such as machine enclosures and exhaust ventilation are preferred.

5.3.2 Method PS 42 may be used for the determination of both particulate total matter and extractable mass metal removal fluid aerosol concentrations in a range of 0.05 to 5 mg/m³ in workplace atmospheres.

5.3.3 See Practice E 1972 for guidelines for minimizing effects of aerosols in the wet metal removal environment.

5.3.4 For additional information, see Criteria for a Recommended standard Occupational Exposure to Metal Working Fluids.⁷

5.4 Ingestion may cause gastrointestinal disturbances.

5.5 Prolonged or repeated dermal contact may cause dry and cracked skin, rash, redness, burning, or itching. Skin abrasions can intensify the effects. Some metal removal fluids and additives may also cause a sensitizing reaction.

6. Fluid Product Selection

6.1 Proper product selection is fundamentally critical to reducing or eliminating occupational dermatitis associated with exposure to metal removal fluids. The metal removal fluids should perform as intended while providing the safest working conditions. The selection of a metal removal fluid for each different operation must fit the inherent limitations of the product. Water-miscible fluids not properly selected are likely to be used at higher concentrations than other products more appropriate to the operation.

6.1.1 Consult “Management of the Metal Removal Environment”⁸ and “Metalworking Fluids Evaluation Guide”⁹ for further information on selecting the proper fluid for the application. In addition, your fluid supplier should be able to provide information on the proper selection of the appropriate fluid and recommended concentration for use.

6.2 Potential health hazards can be minimized by careful fluid selection and substitution. See Guide E 1302.

6.3 The metal removal fluid manufacturer’s material safety data sheet (MSDS) and toxicological data on metal removal fluids, ingredients, and additives shall be reviewed in order to evaluate potential hazards and establish appropriate control procedures.

6.4 Additives, including rust inhibitors, product stabilizers, antimicrobials of all types, odorants, and dyes shall be reviewed for their impact on the metal removal fluid mixture to which they are added. Additives shall only be used with the agreement of the metalworking fluid manufacturer.

6.5 As supplied, antimicrobials and other additives for tankside addition may present greater health and safety risks

⁷ Available from U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 4676 Columbia Pkwy., Cincinnati, OH 45226.

⁸ Available from Organization Resources Counselors, Inc., 1910 Sunderland Place, NW, Washington, DC 20036.

⁹ Available from National Center for Manufacturing Sciences, 3025 Boardwalk, Ann Arbor, MI 48108.

than the metal removal fluid. Further, additives and antimicrobials are less likely to be handled automatically, or with special delivery equipment, than metal removal fluid concentrate so greater care and attention are required to reduce risks of exposure.

6.6 All applicable disposal criteria must be met.

7. Water Quality and Treatment

7.1 Water constitutes more than 90 % of the diluted water miscible metal removal fluid mixture. Water shall be evaluated for hardness, alkalinity, high conductivity, turbidity, corrosivity, biological contaminants, and other factors that may lead to increased use of metal removal fluid concentrate, additives, or antimicrobials, or a combination thereof. Good water quality is fundamental to proper metal removal fluid use, will help minimize use of additives and antimicrobials, and lengthen fluid life. Consult your metal removal fluid supplier.

7.2 Where suitable water is not available, water treatment shall be designed to produce enough water of sufficient quality for metal removal fluid use. Treated water shall be readily available from holding tanks large enough to meet anticipated daily requirements. Treated water quality must be monitored including biological contaminants. Tests performed depend on the type of water treatment used. Guidance on water quality and water treatment may be obtained from the metal removal fluid manufacturer.

8. Receipt and Handling of Fluid and Additives

8.1 Before the fluid is handled, the user shall have an accurate and current material safety data sheet as required by the OSHA Hazard Communication Standard. See 29 CFR 1910.1200.

8.2 Precautions shall be taken to ensure the fluid is, without modification, the fluid represented in the material safety data sheet.

8.3 Users should be informed of modifications in fluid formulation so that they may assess potential effects on health and safety. Seemingly insignificant changes in fluid composition may result in adverse interaction with other additives or may produce unforeseen changes in fluid performance.

8.4 The user shall ascertain that containers when received, are properly labeled and can be easily identified. Specific labeling requirements are set forth in 29 CFR 1910.1200, 40 CFR 156, and other applicable regulations.

8.4.1 Concentrated additives may be corrosive. An eyewash station, at a minimum, should be readily accessible to the user.

8.5 Containers filled in the user's plant shall be properly cleaned, inspected, and labeled, whether used for transport or storage.

8.6 A system shall be in place to ensure bulk deliveries of metal removal fluids are not inadvertently delivered to the wrong storage tank.

8.7 Drums and other portable containers shall be stored indoors or otherwise protected from the weather to protect labels, reduce heating by exposure to sunlight, and reduce rusting of steel containers. Metal removal fluid concentrates and additives shall be stored separately from incompatible

materials, including acids and oxidizers. They shall also be protected from sources of flame, heat, or ignition and protected from freezing.

9. Metal Removal Fluid Sump and System Design

9.1 Where possible use the following design practices for the metal removal fluid sump and system to maintain the chemical integrity of the fluid and to reduce or eliminate contamination.

9.2 Minimize hydraulic fluid contamination by maintaining hydraulic systems and repairing leaks, or by using mechanical clamping, or by locating hydraulic systems external to the metalworking fluid mainstream.

9.3 Separate lubricating oils from metal removal fluids where possible. The metal removal fluid should not be diverted onto the machine ways, unless it is specifically designed to replace way lubricants.

9.4 Design flumes to remove chips and other debris to the metal removal fluid central system as efficiently as possible, while minimizing splashing and misting.

9.5 Machine bases chip shed plates and sloped floors, or both should allow continuous, direct draining to the metal removal fluid central system. Use design features that minimize areas of chip accumulation and stagnation or facilitate regular removal.

9.6 Use oil skimmers to remove non-emulsified, floating tramp oil.

9.7 Use centrifuges and coalescers to remove dispersed and partially emulsified tramp oil.

9.8 Use chip conveyors and modified chip conveyors with filtration devices to remove particulates from the metal removal fluid.

9.9 Review metal removal fluid circulation systems, and minimize or eliminate as appropriate, stagnant areas in pipes or other areas with infrequent fluid circulation.

10. Antimicrobials and Control of Microorganisms in Metal Removal Fluids

10.1 Microorganisms can grow in all metal removal fluids, producing odors and reducing product performance. Antimicrobials are often incorporated into water-miscible metal removal fluid formulations and are commonly added to machine sumps and to centralized water-miscible metal removal fluid systems to control microbial growth.

10.2 Only antimicrobials which are registered for use in metalworking fluids by EPA (Environmental Protection Agency) shall be used in metal removal fluids. Antimicrobial labels state approved uses.

10.3 Antimicrobials are designed to kill microorganisms and therefore have significant biological activity. To avoid potential for harm by mishandling or misapplication, antimicrobials must be handled with care. The user shall read, understand, and follow all appropriate instructions for handling, storage, and use of each antimicrobials as specified by the antimicrobials manufacturer on the material safety data sheet.

10.4 Antimicrobials and combinations of antimicrobials should be evaluated for stability and efficacy in the specific fluid being used or under consideration prior to use. The use of

ineffective antimicrobials may add to the toxicological burden of the metal removal fluid. See Test Methods D 3946 and E 686.

10.5 Certain antimicrobials may release formaldehyde in use. Review fluid and antimicrobial MSDS information, and consult your antimicrobial and/or metal fluid supplier. See 29 CFR 1910.1048.

10.6 Endotoxin in metal removal fluids and their aerosols may present potential respiratory health hazards to workers who inhale them. See Practice PS 94 and consult your metal removal fluid supplier for further information.

10.7 Develop procedures for antimicrobial additions to individual machine sumps and to central metal removal fluid systems that are suited to the location's specific needs. Request the biocide manufacturer or distributor and metal removal fluid manufacturer to assist in the development of these procedures. Antimicrobials are to be added judiciously—in conformance with the manufacturer's recommendations as specified on the container label—and only when needed as determined by those developed procedures. Loss of apparent antimicrobial activity may be due to development of chemical incompatibility or development of resistant populations, or both.

10.8 Antimicrobials should be stored in their original containers and stored in secured areas to prevent unauthorized use.

10.9 Antimicrobials shall be added to the metal removal fluid system at a location that will ensure rapid and complete mixing so as to avoid excessive localized concentrations. Add antimicrobials slowly to ensure mixing and avoid splashing. Mechanical transfer equipment may be used to make antimicrobial additions to reduce the likelihood of skin or eye contact.

10.10 Some antimicrobials have a limited shelf life. Rotate stock regularly and use antimicrobials before the expiration data (if any). Contact the antimicrobial supplier for additional information on use, handling, or disposal.

11. Dermatitis

11.1 As formulated and used in accordance with manufacturer's directions, diluted water-containing metal removal fluids and water-immiscible oils do not cause irritant contact dermatitis. Occupational dermatitis has been associated with exposure to as-received metal removal fluid concentrates as well as to in-use metal removal fluids in some individuals.

11.2 Dermatitis resulting from exposure to metal removal fluids may be either irritant contact dermatitis or allergic contact dermatitis.

11.2.1 Irritant contact dermatitis may be caused by exposure of some individuals to metal removal fluid concentrates, higher-than-recommended in-use metal removal fluid concentrations, high alkalinity, solvents, metal shavings or fines contained in the fluid from a malfunctioning filter or dirty shop rags, or hand washing with abrasive soaps.

11.2.1.1 The longer the exposure to an irritant, the greater the possibility for skin irritation to develop.

11.2.1.2 Activities outside work, such as gardening, painting, or car repair, may contribute to dermatitis.

11.2.2 Allergic contact dermatitis may be caused by exposure of sensitive individuals to some dissolved or suspended metal contaminants, for example, chromium, cobalt, or nickel,

in the metal removal fluid, or some contained ingredients, including some antimicrobials or odorants.

11.2.2.1 The longer the exposure to an irritant, the greater the possibility for skin sensitization to develop in sensitive individuals.

11.3 Any material or activity that abrades the skin or removes natural oils from skin can cause dermatitis or predispose skin to its onset. Environmental factors such as dry air, extreme cold and changing humidity, or idiopathic factors, such as normal aging, may also predispose the skin to dermatitis.

11.4 Folliculitis (oil acne) may be caused by use of straight oils without proper skin protection.

11.5 Bacteria in water-containing metal removal fluids do not cause dermatitis. Certain bacteria and fungi may aggravate or exacerbate the situation and cause a secondary infection.

12. Prevention of Dermatitis Associated With Occupational Exposure to Metal Removal Fluids

12.1 Preventive steps include controlling metal removal fluid concentration and contamination, avoiding prolonged skin contact with the fluid, fluid residues, soiled rags, and clothing, washing exposed skin with warm water and a mild hand cleaner and gently but thoroughly drying prior to each break and before eating. Proper skin care at home or off work is very important.

12.2 Lack of management of and maintenance of metal removal fluid systems is the most significant contributor to occupational dermatitis associated with exposure to metal removal fluids.

12.2.1 Excess tramp oil, which can carry metallic fines, may cause dermatitis, due to mechanical abrasion of the skin with the carried fines.

12.2.2 Water-miscible metal removal fluids that are not carefully controlled for concentration or which contain higher than recommended concentrations of additives can, be much more irritating than fluids that are operating at the manufacturer's recommended concentration.

12.2.3 Malfunctioning filters may increase suspended particulate, such as grinding swarf, abrasive wheel residue, and metallic fines.

12.2.4 Contamination of the metal removal fluid by dissolved metals, such as nickel and chromium, other abrasive particulates, or alkaline materials, such as in-process cleaners, increase occurrences of occupational dermatitis.

12.3 Avoid prolonged contact with skin and prevent fluid from becoming trapped against the skin by gloves, watchbands, belts, and clothing.

12.3.1 Launder soiled clothing regularly.

12.3.2 Clothing that becomes thoroughly soaked with metal removal fluids should be changed immediately. Work clothes that become soaked with metal removal fluids during the day and are hung up over night to dry out will be contaminated with concentrated metal removal fluid residue that, if worn again the next day, may cause skin irritation.

12.4 Shop rags should be free of abrasive dirt, metal fines and contaminant chemicals and should be cleaned as needed.

12.5 After using metal removal fluids, wash with mild soap and water before eating, smoking, using restroom facilities or

applying skin care products. Proper use of appropriate barrier creams may reduce chapping and dryness.

12.5.1 Do not wash skin with solvents, strong detergents or other harsh cleaners.

12.5.2 Workers should use a good quality cream or gel hand cleaner.

12.5.3 The use of good quality barrier creams on exposed skin areas can offer significant protection against the development of dermatitis if used consistently and renewed as necessary throughout the shift.

12.6 Gloves may be effective protection against dermatitis, however, since excellent manual dexterity is often required of machinists with many metal removal fluid processes, some personal protective equipment, such as gloves, may not be appropriate for some operations and may be a serious safety hazard with other operations, such as rotating equipment. The employer may specify operations for which gloves are permitted. If used, gloves should be impervious to the fluid and other ancillary products contacted. Disposal or washable inner gloves may also be considered to eliminate perspiration. If fluid is retained in gloves, the employee should wash exposed skin with warm water and a mild hand cleaner and gently but thoroughly dry. See 29 CFR 1910.138 and 29 CFR 1910, Appendix B to Subpart I.

12.7 Wear aprons or other protective clothing impervious to the metal removal fluid to further reduce skin contact where possible.

12.8 Seasonal conditions, such as may occur during spring and fall, when outdoor relative humidity changes, may contribute to onset of occupational dermatitis. Especially during those times, review, and avoid as appropriate, any off-job activities such as automobile repair and gardening, which may cause the skin to dry and crack.

12.9 Report signs or symptoms of dermatitis associated with exposure to metal removal fluids and obtain appropriate medical attention.

12.9.1 If signs or symptoms of dermatitis associated with exposure to metal removal fluids are reported, the root cause should be identified and corrective action taken. Consult your metal removal fluid supplier.

12.10 Further protective equipment, including chemical suit and respiratory, boots, and gloves impervious to the metal removal fluid or cleaners may be necessary for certain tasks such as fluid system and equipment cleaning, flushing, and maintenance. An evaluation of potential risks is needed to establish specific protective equipment requirements. Guidance concerning use of respirators in the workplace can be found in OSHA 29 CFR 1910.134. Other protective equipment should be used in accordance with 29 CFR 1910, Appendix B to Subpart I, Non-Mandatory Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection.

13. Metal Removal Fluid Management Program

13.1 Management of metal removal fluids is the most important step in improving fluid life and reducing the probability of occurrence of dermatitis and other occupational hazards.

13.2 Establish a metal removal fluid control program to collect data, monitor and evaluate the results, and maintain the

metal removal fluid system within the prescribed limits set by the fluid manufacturer. Health risks and economic losses are enormous when large, centralized metal removal fluid systems get out of control compared to the effort required to maintain control and chemical stability.

13.2.1 Metal removal fluid management programs can be easily integrated with process control requirements of quality systems such as ISO 9001 or OS-9000.

13.3 Metal removal fluid management procedures might include one or more of the following tests: fluid concentration, pH, microbial concentration, dissolved oxygen, antimicrobial concentration, tramp oil level, corrosion protection, and specific tests for critical components or suspected contamination such as suspended particulate matter. Appropriate field test procedures should be supplemented and confirmed by more exact laboratory tests. The metal removal fluid manufacturer can supply an accurate means of determining the fluid concentration and help with selection of parameters to test.

13.4 Test results should be evaluated to determine the amounts of additional metal removal fluid concentrate and additives required to maintain the system at the appropriate concentrations.

13.5 Certain tests, such as concentration, suspended particulate matter, or pH, may be performed every day. Other tests may be performed once or twice weekly, monthly, or even less frequently. The metal removal fluid manufacturer can help determine how frequently each test should be performed.

13.6 The evaluation of accumulated test data is critical to maintaining successful mutual removal fluid management. Operating a metal removal fluid system as close to steady-state (minimum fluctuations of all parameters) as possible will consistently provide the most trouble-free operation with the greatest control of all risks, including health risks. The user and the metal removal fluid manufacturer should work together to maintain system control.

13.7 Chemical additions, maintenance, volume control, and other actions that maintain metal removal fluid system control shall be performed as planned. Timely and deliberate activities should result from evaluation of test data. All additions or changes to a system shall be directed to maintain or restore previously determined chemical, biological, and physical system parameters.

13.8 Test periodically for metal contaminants. Suspended or dissolved metals, or both may contribute to health hazards or fluid degradation, or both. Test for metals present in the materials that are being processed. These include, but are not limited to, aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, tellurium, tin, and zinc. Compare metal contaminant levels in the metal removal fluid shortly after a fresh startup with levels after several months.

13.8.1 Dissolved metal contaminants above 100 ppm increase skin irritation.

13.8.2 Suspended or dissolved metal contaminants may also pose airborne contamination hazards.

13.9 Analyze treated water supplies for anion concentration, because anions may contribute to loss of product stability. In those operations performed on heat-treated, pickled, or surface-treated materials, test regularly for dissolved sulfate and chloride, which can increase rust and corrosion.

13.9.1 Chloride concentrations greater than 50 ppm and sulfate concentrations greater than 100 ppm markedly decrease rust control in many metal removal fluids.

13.10 Do not drain fluid from mist collectors, mop water, rain water, or liquid waste of any kind into metal removal fluid systems. Do not allow metal removal fluid systems to be used as trash conveyor for cigarettes, food, or beverages.

13.11 Keep the fluid aerated; avoid extended periods of non-movement by circulating on weekends and during shut-downs to prevent stagnation.

14. Emergencies

14.1 All emergencies involving metal removal fluids, additives, and fluid systems should be anticipated and planned for.

14.2 Refer to the metal removal fluid manufacturer's material safety data sheet for first aid procedures. The user shall read and understand exposure risks and emergency medical procedures for all metal removal fluids and additives in use. Further, such information shall be made available to all workers exposed to metal removal fluids. Some workers will require specific training and instruction for handling metal removal fluid concentrates and additives.

14.3 In the event of accidental spill of metal removal fluid concentrate, additives or biocides, quickly contain the spill with sand or inert material. Refer to the manufacturer's material safety data sheet for specific clean up procedures.

14.4 Procedures for disposal of metal removal fluids must conform to applicable regulations. Exact and specific limits shall be obtained from the local industrial or sanitary sewer authorities. Treatment, discharge rates, and required testing are specified by those authorities. Unusual and emergency discharges shall be anticipated and limited; overcharges or other exemptions shall be negotiated with sewer district authorities in advance of an actual emergency.

14.5 Those users discharging industrial waste directly to waterways of the United States shall provide wastewater treatment in compliance with applicable permits.

14.6 Do not reuse empty containers for any other product unless the container has been completely cleaned. Relabel any container that is reused. For antimicrobial containers, consult directions for container disposal on label. Other containers should not be reused unless they can be completely cleaned.

15. Keywords

15.1 antimicrobials; dermal exposure; dermatitis; eye contact; ingestion; inhalation; metal removal fluids; metalworking fluids; occupational hazards; occupational health hazards; operator exposure

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