



Standard Guide for Using Documents Related to Metalworking or Metal Removal Fluid Health and Safety¹

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1. Scope

1.1 This guide covers information on how to use documents related to health and safety of metalworking and metal removal fluids. As such, this guide will provide the user with sufficient background information to effectively use the documents listed in Section 2. Documents referenced in this guide are grouped as applicable to producers, to users or to all.

1.2 *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 requirements prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- D1356 Terminology Relating to Sampling and Analysis of Atmospheres
- D7049 Test Method for Metal Removal Fluid Aerosol in Workplace Atmospheres
- E1302 Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids
- E1497 Practice for Selection and Safe Use of Water-Miscible and Straight Oil Metal Removal Fluids
- E1542 Terminology Relating to Occupational Health and Safety
- E1687 Test Method for Determining Carcinogenic Potential of Virgin Base Oils in Metalworking Fluids
- E1972 Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment
- E2144 Practice for Personal Sampling and Analysis of Endotoxin in Metalworking Fluid Aerosols in Workplace Atmospheres
- E2169 Practice for Selecting Antimicrobial Pesticides for

Use in Water-Miscible Metalworking Fluids

- E2523 Terminology for Metalworking Fluids and Operations
- E2563 Test Method for Enumeration of Non-Tuberculosis *Mycobacteria* in Aqueous Metalworking Fluids by Plate Count Method
- E2564 Test Method for Enumeration of *Mycobacteria* in Metalworking Fluids by Direct Microscopic Counting (DMC) Method
- E2657 Test Method for Determination of Endotoxin Concentrations in Water-Miscible Metalworking Fluids
- E2693 Practice for Prevention of Dermatitis in the Wet Metal Removal Fluid Environment
- E2694 Test Method for Measurement of Adenosine Triphosphate in Water-Miscible Metalworking Fluids

2.2 Other Documents:

- Management of the Metal Removal Fluid Environment: A Guide to Safe and Efficient Use of Metal Removal Fluids³
- Criteria for a Recommended Standard: Occupational Exposure to Metalworking Fluids⁴
- Metalworking Fluids: Safety and Health Best Practices Manual⁵

3. Terminology

3.1 For definitions and terms relating to this practice, refer to Terminologies D1356, E1542, and E2523.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *endotoxins, n*—lipopolysaccharides derived from the outer membranes of Gram-negative bacteria.

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

3.2.2.1 *Discussion*—Metal removal fluids addressed by this practice include straight or neat oils, not intended for further

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Organization Resources Counselors, Inc., 1910 Sunderland Place, NW, Washington DC 20036 or at <http://www.orc-dc.com>

⁴ Available from U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Cincinnati, OH 45226.

⁵ Available from US Occupational Health and Safety Administration, 200 Constitution Avenue NW, Washington, DC 20210 or at http://www.osha.gov/SLTC/metalworkingfluids/metalworkingfluids_manual.html

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.

3.2.3 *mutagenicity index, n*—the slope of the dose response curve for mutagenicity in the modified Ames test described in Test Method **E1687**.

4. Significance and Use

4.1 Application of this guide will provide users with information on how to use the various documents listed in Section 2 related to health and safety of metalworking and metal removal fluids.

4.2 Users of the documents listed in Section 2 may fall into several categories, such as producers of metalworking or metal removal fluids, suppliers of raw materials to those producers, users of metalworking or metal removal fluids, and other interested parties, such as non governmental organizations.

4.3 While all parties may wish to be generally familiar with all the documents listed in Section 2, producers and users may each want to focus on certain documents which are directly applicable to them:

4.4 *Documents Applicable to Producers:*

4.4.1 **E1687** *Test Method for Determining Carcinogenic Potential of Virgin Base Oils in Metalworking Fluids*

4.4.1.1 Test Method **E1687** covers a microbiological test procedure based upon the *Salmonella* mutagenesis assay of Ames et. al⁶ (see also Maron et al⁷). It can be used as a screening technique to detect the presence of potential dermal carcinogens in virgin base oils used in the formulation of metalworking oils. Persons who use this test should be well-versed in the conduct of the Ames test and conversant with the physical and chemical properties of petroleum products.

4.4.1.2 Producers of metalworking fluids and metal removal fluids should assure themselves that virgin base oils used in the formulation of neat metalworking and metal removal oils and soluble and semi-synthetic metal removal fluids have an acceptable mutagenicity index or mutagenic potency index.

4.4.2 **E1302** *Guide for Acute Animal Toxicity Testing of Water-Miscible Metal Removal Fluids*

4.4.2.1 Guide **E1302** defines acute animal toxicity tests and sets forth references for procedures to assess the acute toxicity of water-miscible metal removal fluids as manufactured.

4.4.2.2 Application of Guide **E1302** will provide information on the acute toxicity of water-miscible metal removal fluids and will assist the user in evaluating the potential health hazards of the fluid and developing appropriate work practices.

4.5 *Documents Applicable to Users:*

4.5.1 **E1497** *Practice for Selection and Safe Use of Water-Miscible and Straight Oil Metal Removal Fluids*

4.5.1.1 Practice **E1497** sets forth guidelines for the safe use of metal removal fluids, additives and biocides. This includes product selection, storage, dispensing, and maintenance.

4.5.1.2 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 biocides.

4.5.1.3 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.

4.5.2 **E1972** *Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment*

4.5.2.1 Practice **E1972** sets forth guidelines for minimizing effects of aerosols in the wet metal removal environment.

4.5.2.2 Practice **E1972** incorporates all practical means and mechanisms to minimize aerosol generation and to control effects of aerosols in the wet metal removal environment.

4.5.3 **D7049** *Test Method for Metal Removal Fluid Aerosol in Workplace Atmospheres*

4.5.3.1 Test Method **D7049** covers a procedure for the determination of both total collected particulate matter and extractable mass metal removal fluid aerosol concentrations in a range from 0.05 mg/m³ to 5 mg/m³ in workplace atmospheres.

4.5.3.2 Test Method **D7049** describes a standardized means of collecting worker exposure information that can be compared to existing exposure databases, using a test method that is also more specific to metal removal fluids.

4.5.4 **E2144** *Practice for Personal Sampling and Analysis of Endotoxin in Metalworking Fluid Aerosols in Workplace Atmospheres*

4.5.4.1 Practice **E2144** covers quantitative methods for the personal sampling and determination of bacterial endotoxin concentrations in polydisperse metal removal fluid aerosols in workplace atmospheres. Users should have fundamental knowledge of microbiological techniques and endotoxin testing.

4.5.4.2 Endotoxins in metal removal fluid aerosols present potential respiratory hazards to workers who inhale them.

4.5.4.3 Users of Practice **E2144** may obtain personal exposure data of endotoxin in metal removal fluid aerosols, either on a short-term or full-shift basis in workplace atmospheres.

4.5.4.4 Practice **E2144** gives an estimate of the endotoxin concentration of the sampled atmosphere.

4.5.4.5 Practice **E2144** seeks to minimize interlaboratory variation, but does not ensure uniformity of results.

4.5.4.6 It is anticipated that Practice **E2144** will facilitate interlaboratory comparisons of airborne endotoxin data from metalworking fluid atmospheres, particularly metal removal fluid atmospheres, by providing a basis for endotoxin sampling, extraction, and analytical methods.

⁶ Ames, B.N. et al., *Mutation Research*, Vol. 31, 1975, pp. 347-363.

⁷ Maron, D. et al, *Mutation Research*, Vol. 113, 1983, pp. 173-215.