



Standard Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment¹

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1. Scope

1.1 This practice sets forth guidelines for minimizing effects of aerosols in the wet metal removal environment.

1.2 This practice incorporates all practical means and mechanisms to minimize aerosol generation and to control effects of aerosols in the wet metal removal environment.

1.3 *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:²

- D1356 Terminology Relating to Sampling and Analysis of Atmospheres
- E1302 Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids
- E1370 Guide for Air Sampling Strategies for Worker and Workplace Protection
- E1497 Practice for Selection and Safe Use of Water-Miscible and Straight Oil Metal Removal Fluids
- E1542 Terminology Relating to Occupational Health and Safety
- E2144 Practice for Personal Sampling and Analysis of Endotoxin in Metalworking Fluid Aerosols in Workplace Atmospheres
- E2148 Guide for Using Documents Related to Metalworking or Metal Removal Fluid Health and Safety
- E2169 Practice for Selecting Antimicrobial Pesticides for Use in Water-Miscible Metalworking Fluids
- E2250 Method for Determination of Endotoxin Concentra-

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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.

tion in Water Miscible Metal Working Fluids (Withdrawn 2008)³

D7049 Test Method for Metal Removal Fluid Aerosol in Workplace Atmospheres

2.2 OSHA (*US Occupational Safety and Health Administration*) Standards:⁴

29 CFR 1910.134 Use of Respiratory in the Workplace

29 CFR 1910.1200 Hazard Communication

2.3 Other Documents:

ANSI Technical Report B11 TR 2–1997, Mist Control Considerations for the Design, Installation and Use of Machine Tools Using Metalworking Fluids⁵

Metal Working Fluid Optimization Guide, National Center for Manufacturing Sciences⁶

Metal Removal Fluids, A Guide To Their Management and Control, Organization Resources Counselors, Inc.⁷

Industrial Ventilation: A Manual of Recommended Practice.⁸

Criteria for a Recommended Standard: Occupational Exposure to Metalworking Fluids⁹

Metalworking Fluids: Safety and Health Best Practices Manual¹⁰

3. Terminology

3.1 For definitions and terms relating to this guide, refer to Terminology D1356 and E1542.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Code of Federal Regulations available from United States Government Printing Office, Washington, DC 20402.

⁵ Available from Association for Manufacturing Technology, 7901 Westpark Drive, McLean VA 22102.

⁶ Available from National Center for Manufacturing Sciences, Report 0274RE95, 3025 Boardwalk, Ann Arbor, MI 48018.

⁷ Available from Organization Resources Counselors, 1910 Sunderland Place, NW, Washington, DC 20036 or from members of the Metal Working Fluid Product Stewardship Group (MWFPSGSM). Contact Independent Lubricant Manufacturers Association, 651 S. Washington Street, Alexandria, VA 22314, for a list of members of the MWFPSGSM.

⁸ Available from American Conference of Governmental Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati, OH 45240-1634.

⁹ 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.

¹⁰ 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

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dilution ventilation, n*—referring to the supply and exhaust of air with respect to an area, room, or building, the dilution of contaminated air with uncontaminated air for the purpose of controlling potential health hazards, fire and explosion conditions, odors, and nuisance type contaminants, from Industrial Ventilation: A Manual of Recommended Practice.

3.2.2 *extractable mass, n*—the material removed by liquid extraction of the sampling filter using a mixed-polarity solvent mixture as described in Test Method D7049.

3.2.2.1 *Discussion*—This mass is an approximation of the metal removal fluid portion of the workplace aerosol.

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

3.2.3.1 *Discussion*—Metal removal fluids addressed by this guide include straight or neat oils, not intended for further dilution with water, and soluble oils, semisynthetics, and synthetics, all of which are intended to be diluted with water before use.

3.2.4 *metal removal fluid aerosol, n*—Aerosol generated by operation of the machine tool itself as well as from circulation and filtration systems associated with wet metal removal operations and may include airborne contaminants of a microbial origin.

3.2.4.1 *Discussion*—Metal removal fluid aerosol does not include background aerosol in the workplace atmosphere, which may include suspended insoluble particulate.

3.2.5 *total particulate matter, n*—the mass of material sampled through the 4-mm inlet of a standard 37-mm filter cassette when operated at 2.0 L/min, as described in Test Method D7049.

3.2.5.1 *Discussion*—As defined in Test Method D7049, total particulate matter is not a measure of the inhalable or thoracic particulate mass.

4. Significance and Use

4.1 Use of this practice will minimize occupational exposure to aerosols in the wet metal removal environment.

4.2 Excessive exposures to metal removal fluid aerosols are associated with machinist complaints of respiratory irritation.

4.3 Through implementation of this practice and incorporation of a metal removal fluid management program, appropriate product selection, appropriate machine tool design, selection, and maintenance, and control of microorganisms, users should be able to minimize complaints of machinist respiratory irritation.

5. Metal Removal Fluid Management

5.1 Management of metal removal processes is the most important step in minimizing exposure to metal removal fluid aerosols. As factors affecting aerosol generation are interdependent, a systems approach to metal removal process management will be the most effective approach.

5.2 Aerosolization of metal removal fluids may result in airborne exposure not only to the formulated components of

the fluid, but also to contaminants introduced into the fluid systems while in use, including microbial contaminants.

5.3 Establish a metal removal fluid control program. Additional detailed guidance may be found in Practice E1497 and in Metal Removal Fluids, A Guide To Their Management and Control. Consult with your metal removal fluid suppliers.

6. Product Selection

6.1 Fluids vary in their misting characteristics. Select fluids with an understanding of their misting characteristics, bearing in mind available engineering control measures. Some fluids mist less, other factors being equal. Misting characteristics may change significantly with contamination. Some fluids retain entrained air, causing a significant increase in mist generation, possibly in areas away from the metal removal fluid operation. Polymeric additives may be useful in reducing aerosol from straight or neat oils and some water-miscible metal removal fluids. Components or contaminants may be more concentrated in the aerosol phase relative to their concentrations in the bulk fluid.

6.2 Practice E1497 and Metal Removal Fluids, A Guide To Their Management and Control describe product selection criteria. While specifically directed towards water-miscible metalworking fluids, the same principles generally apply to selection of neat or straight metal removal fluids.

6.3 Select fluids with an understanding of their acute and chronic toxicity characteristics. Guide E1302 references procedures to assess the acute toxicity of water-miscible metalworking fluids as manufactured. Review the material safety data sheet, required by 29 CFR 1910.1200, for health and safety information for the metal removal fluids being considered for the operation.

6.4 With due consideration for available engineering controls, select fluids that minimize components that may be irritating or may produce objectionable odors.

6.5 As the concentration of metal removal fluid in the machining system sump or reservoir increases, the level of chemicals in the metal removal fluid aerosol increases and the net exposure is greater. Maintaining proper metal removal fluid concentration while in use enhances machining performance and minimizes exposure potential.

7. Machine Tool Design, Selection, and Maintenance

7.1 ANSI B-11 TR 2-1997 provides guidance concerning consideration for the design of metalworking fluid delivery systems, of machine tools, of machine enclosures for the control of airborne contaminants, of exhaust ductwork from machine tool enclosures, and of mist collectors, and guidelines for testing collection systems. Users of this practice should be well-versed in these considerations and implement them when practical where occupational exposures to metal removal fluids is expected to occur.

7.2 Design metal removal fluid delivery systems to minimize generation of metal removal fluid aerosols. For transfer line machines, as the earliest operation in the line is often the heaviest cut, early operations may contribute most to metal removal fluid aerosol generation.