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An American National Standard

Standard Practice for Minimizing Effects of Aerosols in the Wet Metal Removal Environment[1]

This standard is issued under the fixed designation E 1972; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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:*

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres[2]

E 1302 Guide for Acute Animal Toxicity Testing of Water-Miscible Metalworking Fluids[2]

E 1370 Guide for Air Sampling Strategies for Worker and Workplace Protection[2]

E 1497 Practice for Safe Use of Water-Miscible Metalworking Fluids[2]

E 1542 Terminology Relating to Occupational Health and Safety[2]

PS 42 Provisional Test Method for Metal Removal Fluid Aerosol in Workplace Atmospheres[2]

2.2 *OSHA (US Occupational Safety and Health Administration) Standards:*[3]

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 Fluids[4]

Metal Working Fluid Optimization Guide, National Center for Manufacturing Sciences[5]

Metal Removal Fluids, A Guide To Their Management and Control, Organization Resources Counselors, Inc.[6]

Industrial Ventilation: A Manual of Recommended Practice.[7]

3. Terminology

3.1 For definitions and terms relating to this guide, refer to Terminology D 1356 and E 1542.

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 PS 42.

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.

[1] This guide is under the jurisdiction of ASTM Committee E34 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 11.03.

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

[4] Available from Association for Manufacturing Technology, 7901 Westpark Drive, McLean VA 22102.

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

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

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

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 PS 42.

3.2.5.1 *Discussion*—As defined in Test Method PS 42, 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 E 1497 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 E 1497 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 E 1302 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.

7.3 Maintain metalworking fluid delivery system components, including pumps. Leaking seal packing, leaking mechanical seals, and leaking ports in delivery pumps entrain air in the metal removal fluid, significantly increasing aerosol generation.

7.4 Cover flumes and other sources of aerosol generation. Vent them to the metal removal fluid reservoir, if feasible, to minimize release of aerosol or to maintain negative pressure.

7.5 Select new machining and grinding equipment with enclosures and appropriate ventilation that minimizes generation of metal removal fluid aerosols in the workplace atmosphere.

7.6 Maintain existing equipment enclosures and guarding to minimize release of aerosol. Restore missing equipment and enclosures. If enclosures are not maintained or guarding is removed, larger particles may escape through openings in the enclosure.

7.7 Retrofitting existing equipment should be considered using ANSI B-11 TR 2-1997 as a guide. Unless properly designed and constructed, retrofits may not significantly capture metal removal fluid aerosols.

7.8 Properly design and maintain exhaust ductwork from machine tool enclosures. ANSI B 11 TR 2-1997 may be used as a guide. Inspect and clean ductwork regularly, and repair ductwork not in good working order.

7.9 Properly design and maintain mist collectors, ANSI B 11 TR 2–1997 may be used as a guide. Other technologies may be appropriate. Poorly maintained mist collectors may increase