



Standard Terminology for Metalworking Fluids and Operations¹

This standard is issued under the fixed designation E2523; 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 terminology standard provides a compilation of ASTM and non-ASTM consensus definitions of terms used in the metalworking industry.

1.2 This terminology standard does not purport to be an exhaustive lexicon. Rather it defines terms relevant to metalworking fluid management and metalworking fluid health and safety.

1.3 This terminology standard defines primary metalworking operations, fluid types and other terms germane to the practice of metalworking fluid management.

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:²

- D1356 Terminology Relating to Sampling and Analysis of Atmospheres
- D2881 Classification for Metal Working Fluids and Related Materials
- D6161 Terminology Used for Microfiltration, Ultrafiltration, Nanofiltration and Reverse Osmosis Membrane Processes
- 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

- 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
 - 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
 - E2275 Practice for Evaluating Water-Miscible Metalworking Fluid Bioresistance and Antimicrobial Pesticide Performance
 - 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 Government Standards:³
- 29 CFR 1910.1200 Occupational Safety and Health Standards, Hazard Communication
 - 40 CFR 156 Labeling Requirements for Pesticides and Devices

3. Significance and Use

3.1 Personnel from a wide range of disciplines contribute to metalworking fluid management and plant environment health and safety management. Consequently, terms familiar to some stakeholders will be unfamiliar to others.

¹ This terminology 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 Metal Working Fluids.

Current edition approved Jan. 1, 2011. Published February 2011. Originally approved in 2006. Last previous edition approved in 2007 as E2523 - 07. DOI: 10.1520/E2523-11.

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 U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

3.2 This terminology standard provides, in a single document, a compilation of definitions used by personnel involved with both metalworking environment health and safety and fluid management.

3.3 Use of terms as defined in this terminology standard will enable all stakeholders to use metalworking industry terms in the appropriate context, thereby improving interdisciplinary communications.

4. Terminology

acid-fast bacteria, *n*—a distinctive staining property of *Mycobacteria* due to their lipid-rich cell walls.

DISCUSSION—Once stained, mycobacterium resist decolorization when exposed to acidified organic solvents, and are therefore, informally designated acid-fast. **E2564**

active ingredient (a.i.), *n*—the chemical or components of an antimicrobial pesticide that provides its antimicrobial performance. **E2169, E2275**

acute dermal toxicity, *n*—health hazards likely to arise from short-term exposure to a substance via the skin or mucosa. **E1302**

DISCUSSION—Results of acute dermal toxicity testing may provide initial information on the dermal absorption and the mode of toxic action of a substance. Moreover, some measure of irritation caused by the fluid may be obtained by observing local tissue damage at the site of application. Endpoint: mortality.

acute inhalation toxicity, *n*—the potential of a fluid, vapor, or gas to cause death and other adverse health effects when inhaled for a specified time period. **E1302**

DISCUSSION—The endpoint may be mortality or other specific health effect designated in the test protocol.

acute oral toxicity, *n*—health hazards likely to arise from short-term exposure to a substance via the oral route (ingestion). **E1302**

DISCUSSION—Results of acute oral toxicity tests are used to develop warning statements on labels as may be required by OSHA Hazard Communication Standard 29 CFR 1910.1200 or Federal Hazardous Substances Act. These are also used to establish a dosage regimen for subchronic and other testing. Endpoint: mortality.

adenosine monophosphate (AMP), *n*—the molecule formed by the removal of two molecules of phosphate (one pyrophosphate molecule) from ATP. **E2694**

adenosine triphosphate (ATP), *n*—a molecule comprised of a purine and three phosphate groups that serves as the primary energy transport molecule in all biological cells. **E2694**

aerosol, *n*—a dispersion of solid or liquid particles in a gaseous medium. **D1356**

antimicrobial pesticide, *n*—chemical additive registered under 40 CFR 156, for use to inhibit growth, proliferation or both of microorganisms. **E2169, E2275**

DISCUSSION—Antimicrobial pesticides are registered for one or more end-use applications, or sites, for use within an approved dose range.

aseptic, *adj*—sterile, free from viable microbial contamination. **E2694**

as supplied (a.s.), *adj*—antimicrobial pesticide finished prod-

uct including the active ingredients, solvent and any additional inactive ingredients. **E2275**

bactericide, *n*—an antimicrobial pesticide specifically or primarily effective against bacteria. **E2169**

background RLU, *n*—the quantity of relative light units resulting from running the Method without incorporation of the sample. **E2694**

bioburden, *n*—the level of microbial contamination (biomass) in a system. **E2169**

DISCUSSION—Typically, bioburden is defined in terms of either biomass or numbers of cells per unit volume or mass or surface area material tested (g biomass/mL; g biomass/g sample; cells/mL sample; colony forming units (CFU)/mL sample and so forth).

biocide, *n*—any chemical intended for use to kill organisms. **E2169, E2275**

DISCUSSION—Biocide is a term usually used synonymously with the preferred *antimicrobial pesticide* or *microbicide*.

biodeterioration, *n*—the loss of commercial value, performance characteristics or both of a product (metalworking fluid) or material (coolant system or finished parts) through biological processes. **E2169**

biofilm, *n*—a film or layer composed of microorganisms, biopolymers, water, entrained organic and inorganic debris that forms as a result of microbial growth, proliferation and excretion of polymeric substances at phase interfaces (liquid-liquid, liquid-solid, liquid-gas, and so forth). (synonym: *skinnogen layer*). **E2169**

bioluminescence, *n*—the production and emission of light by a living organism as the result of a chemical reaction during which chemical energy is converted to light energy. **E2694**

biomass, *n*—any matter which is or was a living organism or excreted from a microorganism **D6161**

bioresistant, *adj*—ability to withstand biological attack. **E2169, E2275**

DISCUSSION—Bioresistant, or recalcitrant, chemicals are not readily metabolized by microorganisms.

biostatic, *adj*—able to prevent existing microbial contaminants from growing or proliferating, but unable to kill them. **E2169, E2275**

DISCUSSION—Biostatic additives may be registered antimicrobial pesticides or unregistered chemicals with other performance properties. The difference between biocidal and biostatic performance may be attributed to dose, chemistry or both.

boring, *v*—enlarging a hole that already has been drilled.

DISCUSSION—Generally boring is an operation of truing the previously drilled hole with a single-point, lathe-type tool. Boring is essentially internal turning.

breathing zone, *n*—that location in the atmosphere at which persons breath. **D1356**

DISCUSSION—The worker's breathing zone consists of a hemisphere 300-mm radius in front of the face and measured from a line bisecting the ears. **D7049**

broaching, *v*—an operation in which a cutter progressively enlarges a slot or hole or shapes a workpiece exterior.

DISCUSSION—Low teeth start the cut, intermediate teeth remove the majority of the material and high teeth finish the task. Broaching can be a one-step operation, as opposed to milling and slotting, which require repeated passes. Typically, however, broaching also involves multiple passes.

bubbler, *n*—a sampling device consisting of a gas dispenser immersed in an absorbing liquid. **E1356**

coining, *v*—a closed-die squeezing operation in which all surfaces of the work are restrained (coined).

DISCUSSION—Coining often imparts a pattern or shape onto the workpiece. Coining also refers to a press-brake bending operation in which the punch bottoms against the workpiece and the die. It also refers to a process similar to bottoming although greater force is applied. Coining alters the radius, and bottoming sets the bend open but does not affect shape.

collector, *n*—a device for removing and retaining contaminants from air or other gases. **E1356**

contaminant, *n*—substances contained in in-use metalworking fluids that are not part of the received fluid, such as abrasive particles, tramp oils, cleaners, dirt, metal fines and shavings, dissolved metal and hard water salts, bacteria, fungi and microbiological decay products, and waste. **E1497**

contamination control, *n*—maintenance of bioburden at an operationally defined level, at or below which the bioburden does not affect the fluid or system adversely. **E2169**

control, *v*—to prevent, eliminate or reduce hazards related to the use of metalworking fluids in metalworking processes and to provide appropriate supplemental, or interim protection, or both, as necessary, to employees. **E1497**

control standard endotoxin (CSE), *n*—a purified preparation of endotoxin based on the USP Reference Standard Endotoxin (RSE); used in laboratories to prepare standard solutions. **E2657**

coolant, *n*—any liquid used for the purpose of facilitating heat removal from metal removal, forming or both types of metalworking operations.

DISCUSSION—Coolants are typically classified by the general chemical composition as emulsifiable oils, semi-synthetic oils, straight oils or synthetic fluid (Classification **E2881**). See definitions 4.32, 4.72, 4.77 and 4.78, respectively. Coolants are used primarily to cool and lubricate.

culturable, *adj*—microorganisms that proliferate as indicated by the formation of colonies on solid growth media or the development of turbidity in liquid growth media under specific growth conditions. **E2694**

demand, *n*—the sum of all factors that contribute to decreasing the effective concentration of antimicrobial pesticide. **E2169**

DISCUSSION—Processes contributing to demand include, but are not limited to, reactions with microbes, reactions with other chemicals in the fluid, adsorption onto surfaces, absorption into materials and temperature.

dermatitis, *n*—an inflammatory response of the skin. **E1497**

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.

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. **E2693**

dose, *n*—concentration of antimicrobial pesticide added to treated solution. **E2169, E2275**

DISCUSSION—Dose is generally expressed as either ppm active ingredient (a.i.) or ppm as supplied (a.s.).

drawing, *v*—process by which a metal blank is forced to flow through a die cavity without any constraint other than against buckling.

DISCUSSION—Internal resistance flow of the metal towards the punch and dies sets up compressive stresses which, combined with tensile stresses created by the motion of the punch, produce two-dimensional shear.

drilling, *v*—operation in which a rotating tool is used to create a round hole in a workpiece.

DISCUSSION—Drilling is normally the first step in machining operations such as boring, reaming, tapping, counterboring, countersinking and spotfacing.

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 metalworking fluid. **E1497**

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

emulsifiable oil, *n*—a metalworking fluid that contains >30 % petroleum, synthetic, or vegetable oil plus emulsifiers, corrosion inhibitors and other additives. **D2881**

endotoxin, *n*—a lipopolysaccharide derived from the outer membrane of Gram-negative bacteria. **E1497, E2144, E2657**

endotoxin unit (EU), *n*—a biological potency unit equivalent to the FDA Reference Standard Endotoxin (RSE). **E2144, E2657**

DISCUSSION—Currently EC-6 is equivalent to 0.1 ng 3D 1 EU.

exposure, *n*—contact with a chemical, biological, physical or other agent over a specified period time. **D1356**

DISCUSSION—Exposure is expressed as the integral of the concentration (or intensity) of the agent at the boundary of the receptor over the time period of contact, that is, $E \sim \int |C(t)| dt$.

extractable mass, *n*—the material removed by the liquid of the sampling filter using a mixed polarity mixture as described in Test Method **D7049**. **E1972**

DISCUSSION—This mass is an approximation of the metalworking fluid portion of the workplace aerosol.

eye irritation, *n*—damage or inflammatory effect caused to the eye due to exposure to a chemical substance.

folliculitis, *n*—an inflammatory reaction in hair follicles.
E1497

forming, *v*—process in which material is stamped, stretched, bent or given a new shape without intentionally removing material.

fume, *n*—properly, the solid particles generated by condensation from the gaseous state, generally after volatilization from melted substances, and often accompanied by a chemical reaction such as oxidation.
D1356

DISCUSSION—Fumes flocculate and sometimes coalesce. Popularly, the term is used in reference to any or all types of contaminant, and in many laws or regulations with the added qualification that the contaminant has some unwanted action.

fungicide, *n*—antimicrobial pesticide specifically or primarily effective against fungi.
E2169

gram-negative bacteria, *n*—prokaryotic cells that have a complex cell-wall structure that stains characteristically when subjected to the differential Gram staining procedure.
E2657

grinding, *v*—machining operation in which material is removed from the workpiece by a powered abrasive wheel, stone, belt, paste, sheet, compound, slurry, etc.

gundrilling (gunning), *v*—drilling process using a single-lip, self-guiding tool to produce deep precise holes.

DISCUSSION—During gunning, high-pressure coolant is fed to the cutting area, usually through the gundrill's shank.

half-life ($T_{1/2}$), *n*—time required for concentration of a microbicide to diminish to one-half its original concentration.

honing, *v*—a low-velocity abrading process by which material removal is accomplished at lower cutting speeds than in grinding.

DISCUSSION—In honing, heat and pressure are minimized, resulting in excellent size and geometry control. The most common application of honing is internal cylindrical surfaces. The cutting action is obtained using abrasive sticks (aluminum oxide and silicon carbide) mounted on a metal mandrel.

impactor, *n*—a device for collecting airborne or emission particulate matter in which the air or gas being sampled is impacted or impinged against a surface.
D1356

DISCUSSION—A cascade impactor is a type of impactor which employs several stages of impaction in series to collect successively smaller sizes of particles.

impingement, *n*—the act of bringing matter forcibly in contact.
D1356

DISCUSSION—As used in air sampling, impingement refers to a process for the collection of particulate matter in which the gas being sampled is directed forcibly against a surface.

impinger, *n*—broadly, a sampling instrument employing impingement of the collection of particulate matter.
D1356

inactive ingredient, *n*—component of antimicrobial pesticide that is not directly responsible for the pesticide's antimicrobial performance.
E2275

DISCUSSION—Inactive ingredients may include, but are not limited to solvents and chemicals that improve the pesticide's non-biocidal performance properties, such as miscibility and reactivity with non-target molecules in the treated material.

lethal dose, *n*—a concentration (usually mass of treatment agent per unit mass of test subject) at which treatment kills at least one of test subjects.
E2169

DISCUSSION—The LD₅₀ is the term used in toxicology defining the dose that kills fifty-percent of the test population.

limulus amebocyte lysate (LAL) assay, *n*—a biological assay that detects endotoxin.
E2144

limulus amebocyte lysate (LAL) assay, *n*—a biological assay dependent on a series of cascading enzyme reactions that occur when Limulus blood cell (amebocyte) lysate combines with endotoxin.
E2657

Luciferase, *n*—a general term for a class of enzymes that catalyze bioluminescent reactions.
E2694

Luciferin, *n*—a general term for a class of light-emitting biological pigments found in organisms capable of bioluminescence.
E2694

luminometer, *n*—an instrument capable of measuring light emitted as a result of non-thermal excitation.
E2694

lysis, *n*—refers to the death of a biological cell by breaking of the cellular membrane
E2694

metalfforming, *v*—see *forming*.

metalfforming fluid, *n*—any fluid in the subclass of metalworking fluids used for the purpose of drawing, rolling stamping or other metal shaping process.

metal removal fluid (MRF), *n*—any fluid in the subclass of metalworking fluids used to cut, or otherwise take away material or piece of stock.
E2148

DISCUSSION—Metal removal fluids include straight or neat oils (D2881), 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. (E2148)

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 microbial origin.
E1972

DISCUSSION—Metal removal aerosol does not include background aerosol in the workplace atmosphere, which may include suspended insoluble particulates.

metal removal process, *n*—a manufacturing process that removes metal during shaping of a part, including machining processes, such as milling, drilling, turning, broaching, tapping and grinding processes, as well as honing and lapping, and other similar mechanical operations in which metal is removed to form a finished part.
E1497

metalworking fluid (MWF), *n*—any fluid used for the purpose of cooling or treating metal surfaces during metal removal, metal forming or surface protection or preservation.

microbicide, *n*—synonymous with antimicrobial pesticide. **E2169**

microscopic factor (MF), *n*—a calibrated conversion factor for calculating the Mycobacterium count per mL.

DISCUSSION—The average number of mycobacterium cells per one microscopic field (or oil field, OIF) is multiplied by the MF to give the concentration of mycobacterium per mL of sample. **E2564**

milling, *v*—machining operation in which metal or other material is removed by applying power to a rotating cutter.

DISCUSSION—Milling takes two general forms. In vertical milling, the cutting tool is mounted vertically on the spindle. In horizontal milling, the cutting tool is mounted horizontally, either directly on the spindle or on an arbor. Horizontal milling is further broken down into conventional milling, where the cutter rotates opposite the workpiece; and climb milling, where the cutter rotates in the direction of the feed.

minimum inhibitory concentration (MIC), *n*—lowest treatment-dose that will prevent test population from growing, proliferating or otherwise contributing to biodeterioration. **E2169, E2275**

mist, *n*—liquid, usually water in the form of particles suspended in the atmosphere at or near the surface of the earth; small water droplets floating or falling, approaching the form of rain and sometimes distinguished from fog as being more transparent or as having particles perceptibly moving downward. **D1356**

mutagenicity index (MI), *n*—the slope of the dose response curve for mutagenicity in the modified Ames test. **E1687**

DISCUSSION—MI is an index of relative mutagenic potency.

non-tuberculous Mycobacteria (NTM)—environmental mycobacteria, not associated with tuberculosis. **E2564**

odor, *n*—that property of a substance which affects the sense of smell; any smell; scent; perfume. **D1356**

odor threshold, *n*—the concentration of an odorous compound at which the physiological effect elicits a response 50 % of the time. **D1356**

oil immersion field (OIF), *n*—the circular area of a microscopic field visible in the eye piece of the microscope using oil immersion objective. **E2564**

personal sampler, *n*—a portable sampling instrument that is attached to a person to ascertain the concentration of specific constituents in the air in the person's breathing zone. **E2144**

polycyclic aromatics (PCA), *n*—for the purposes of this test method, PCA refers to fused-ring polycyclic aromatic compounds with three or more rings. **E1687**

DISCUSSION—Examples of this hydrocarbon series include phenanthrene (3), pyrene (4), benzopyrene (5), dibenzopyrene (6) and coronene (7). Heterocyclic polynuclear compounds are also included in this definition. Polycyclic aromatics are also referred to as polynuclear aromatics (PNA) and polycyclic aromatic hydrocarbons (PAH).

pyrogen-free (PF), *adj*—material(s) devoid of measurable endotoxin activity. **E2657**

rapidly growing mycobacteria (RGM), *n*—non-tuberculosis *Mycobacteria* that grow and produce visible colonies in four to seven days. **E2563**

reaming, *v*—a machining process that uses a multi-edge, fluted cutting tool to smooth, enlarge or accurately size an existing hole.

relative light unit (RLU), *n*—an instrument-specific unit of measurement reflecting the number of photons emitted by the Luciferin-Luciferase driven hydrolysis of ATP to AMP plus pyrophosphate.

DISCUSSION—RLU is not an SI unit, however, RLU are proportional to ATP concentration. **E2694**

roll forming, *v*—a process for forming cylindrical or semicylindrical shapes from sheet or plate by feeding the work edgewise into the gap between a cluster of at least three relatively small diameter straight rolls.

DISCUSSION—The size of the gap between rolls, and its relationship to sheet thickness, determines the bend radius in the finished cylinder. Roll bending is also used to form solid bars, rods, heavy-wall tubes and special shapes into desired shapes.

sawing, *v*—machining operation in which a powered machine, usually equipped with a blade having milled or ground teeth is used to part material (cutoff) or give it a new shape (contour bandsawing).

DISCUSSION—The four basic types of sawing operations are: 1) hacksawing: power or manual operation in which the blade moves back and forth through the work, cutting on one of the strokes; 2) cold or circular sawing: a rotating, circular, toothed blade parts the material; 3) bandsawing: a flexible, toothed blade rides on wheels under tension and is guided through the work; and 4) abrasive sawing: abrasive points attached to a fiber or metal backing part stock.

semi-synthetic oil, *n*—a metalworking fluid that contains ≤ 30 % petroleum or vegetable oil, plus emulsifiers, corrosion inhibitors and other additives.

DISCUSSION—Semi-synthetic oils generally form micro-emulsions (average micelle size <1.0 μm dia.) when diluted with water for end use.

sensory irritation, *n*—discomfort or burning sensation of the eyes, nose or throat, or cough caused by exposure to a chemical substance (sensory irritant).

skin corrosion, *n*—visible destruction of, or irreversible alterations in living tissue caused by chemical action at the site of contact. **E1302**

skin irritation, *n*—a reversible inflammatory effect on living tissue by a chemical reaction at the site of contact. **E1302**

skin sensitization, *n*—an allergic reaction in normal tissue after repeated exposure to a chemical.

DISCUSSION—Chemical sensitizers are materials that cause a substantial proportion of exposed individuals to become sensitized after repeated exposure.

straight oil, *n*—a metalworking fluid that contains essentially no water and is not emulsifiable in water.

DISCUSSION—Straight oils may contain corrosion inhibitors, lubricity agents and other additives. **D2881**

synthetic fluid, *n*—a metalworking fluid that contains no oil

and forms a true solution (no micelles) when mixed with water.

DISCUSSION—Classification **D2881** categorizes synthetic fluids as non-petroleum oil containing solution synthetic fluids, emulsion synthetic fluids or straight synthetic oils, depending on whether the finished product forms a true solution or emulsion with water, or is immiscible with water. For the purposes of this document synthetic fluid is synonymous with solution synthetic fluid.

tapping, *v*—machining operation in which a tap with teeth on its periphery, cuts internal threads in a pre-drilled hole having a smaller diameter than the tap diameter.

DISCUSSION—Threads are formed by a combined rotary and axial-relative motion between tap and workpiece.

tramp oil, *n*—oil and oil-soluble additives, sometimes insoluble, resulting from leaking hydraulic, spindle, slide-way, or gear oil into the metalworking fluid. **E1497**

DISCUSSION—Tramp oils may contaminate the metalworking fluid with components that are emulsifiable but which are not parts of the metalworking fluid as formulated.

vapor, *n*—the gaseous phase of matter that normally exists in a liquid or solid state. **D1356**

viable microbial biomass, *n*—metabolically active (living) microorganisms. **E2694**

wet metalworking fluid environment, *n*—the workplace environment in which wet metalworking operations occur.

5. Symbols, Abbreviations, and Acronyms

- 5.1 *AFB*—acid fast bacteria
- 5.2 *AMP*—adenosine monophosphate
- 5.3 *a.i.*—active ingredient
- 5.4 *a.s.*—as supplied
- 5.5 *ATP*—adenosine triphosphate
- 5.6 *CFU*—colony forming unit
- 5.7 *DMC*—direct microscopic count
- 5.8 *EU*—endotoxin unit
- 5.9 *LAL*—Limulus amebocyte lysate
- 5.10 *MF*—microscopic field
- 5.11 *MI*—mutagenicity index
- 5.12 *MIC*—minimum inhibitory concentration
- 5.13 *MRF*—metal removal fluid
- 5.14 *MWF*—metalworking fluid
- 5.15 *NTM*—non-tuberculosis mycobacteria
- 5.16 *PCA*—polycyclic aromatic
- 5.17 *PF*—pyrogen free
- 5.18 *RGM*—rapidly growing mycobacteria
- 5.19 *TWA*—time weighted average

6. Keywords

coolants; emulsifiable oils; metal forming; metal removal; metalworking; soluble oils; synthetic fluids; terminology

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the ASTM website (www.astm.org/COPYRIGHT/).