



Workplace Safety

Exploring the Safety Dangers of Metalworking Fluids

Don Sears | Feb 15, 2018

What You Need to Know:

The coolants, lubricants and fluids used in the temperature-balancing application of metal materials work contain chemical compounds that can be harmful at high exposure levels if not handled properly. For metalworking fluids, the consensus industry standards appear to have more directional pull than the regulatory bodies or worker advocacy groups, but you should always know and follow OSHA's standards.

OSHA, in consensus with the voluntary standards organization ASTM International, recommends that manufacturers follow engineering and work practice controls, use appropriate PPE, establish a metalworking fluid management program and provide employee train

The chemical compounds used in today's fluids have come a long way-and when businesses follow the guidelines for engineering controls, protective equipment and industry guidelines, worker safety goes way up. But all these things need to work harmoniously

Are metalworking fluids dangerous? The simple answer for safety managers is: They can be in the wrong amounts. If you follow industry best practices and guidelines, you can significantly reduce the risks of respiratory harm and skin damage.

While less talked about than fall prevention or eye protection, shielding workers from overexposure to chemical compounds in metalworking fluids is no less critical and, in some ways, more complicated.

There are roughly 1.2 million workers in machine tooling and finishing operations in the United States who are potentially exposed to harmful levels of fluids from metalworking, according to the National Institute for Occupational Safety and Health. Metalworking fluids are known to cause hypersensitivity pneumonitis, chronic bronchitis, impaired lung function, asthma and dermatitis on the skin. Work-related asthma is a highly prevalent occupational disorder especially in manufacturing, according to the *Centers for Disease Control*.

"The No. 1 issue when it comes to the safety of metalworking fluids is mist collection," says *Dr. Fred Passman*, president of BCA Inc. a microbial contamination control services company in Princeton, New Jersey.

The coolants, lubricants and fluids used in the temperature-balancing application of metal materials

work contain chemical compounds that can be harmful. Do these chemicals cause cancer? There have been incidents in the past, during and after the World War II boom in manufacturing, but long-term data since then is inconclusive, according to industry experts and the courts. That does not mean it can be completely ruled out, making exposure a sometimes controversial topic, as the data needed to fully evaluate the risks require long-term studies.

Boiling It Down: Where to Focus Metalworking Fluid Safety

In today's metalworking environments, safety managers, plant operations managers and workers seeking to address potentially dangerous metalworking fluid exposure need to focus on two areas that may seem obvious: mist inhalation and skin exposure, says safety expert Dr. Fred Passman.

To a lesser degree, there are chips that come off metal removal that can nick up the arms and hands—making gloves and goggles important.

"When grinding or performing other work with fluids, machine operators are constantly being hit by tiny, tiny razor-like chips from the removal work," notes Passman, chairman of the ASTM Subcommittee E.34.50 Health and Safety of Metalworking Fluids. "People often say it's the fluids, but it's really the combination of the high PH of fluids sucking the protective barrier of the skin and the tiny cuts that occur from chipping."

Another key safety area to focus on is proper outbound and inlet ventilation to ensure fresh air in the "breathing zone" for workers. Think about this: A facility might have terrible ventilation. It may be a tall space. It can be tough to have fresh air if air movement is not from the ground up. Many newer buildings will have louvres around the floor. In older plants, the inlet air source may be higher off the ground than what is needed in the breathing zone.

"Sometimes, it can be something as simple as the inlet air not being in the right place," Passman says. "The overall plant air exchange may be terrific, but if air below the breathing level isn't there, then you have issues. Don't just look at overhead venting. You need to test for the inlet air flow too."

For more information, please see OSHA's *"Metalworking Fluids: Safety and Health Best Practices Manual,"* NIOSH's *metalworking fluids guidance* material and ASTM International's *"Standard Practice for Selection and Safe Use of Water-Miscible and Straight Oil Metal Removal Fluids."*

In regards to a possible cancer threat, NIOSH puts it this way: "Substantial evidence indicates that some metalworking fluids are associated with an increased risk of larynx, rectum, pancreas, skin, scrotum and bladder cancer. Because the time between initial exposure to a carcinogen and the appearance of most types of cancer is often 20 or more years, these studies most likely reflect the cancer risk associated with exposure conditions in the mid-1970s and earlier."

The manufacturing industry has made significant strides over the last several decades, NIOSH goes on to say in its report, *"What You Need to Know About Occupational Exposure to Metalworking Fluids."*

Collective understanding of what constitutes safe levels of exposure has dramatically evolved over the

last 30 years, as have the ingredients and formulas used in these fluids, including the removal of polynuclear aromatic hydrocarbons from fluids (which began in the 1950s) and a reduction in nitrosamine exposure (which followed a change in U.S. Environmental Protection Agency regulations in the 1980s).

The Standards and the Consensus Standards: OSHA, NIOSH, ASTM

As usual, there are a multitude of standards covering metalworking fluids. Consensus industry standards appear to have more directional pull, however, than the regulatory bodies or worker advocacy groups. One of the reasons for that may lie in the sheer volume of coolant and fluid variety used across a wide range of metal applications in manufacturing.

"Metalworking fluids are actually a broad category of substances. They can be petroleum- or water-based and natural, synthetic or semisynthetic. In addition, they are mixtures and may contain additional chemicals intended as emulsifiers, antiweld agents, corrosion inhibitors, buffers, biocides and more," *notes* Safety BLR.

OSHA Standard **1910 Subpart Z - Toxic and Hazardous Substances** for general industry states that the limits for permissible levels of air contaminants commonly defined as "oil mists" should be no greater than 5 milligrams per cubic meter. OSHA also sets 5 mg/m³ as the permissible level for what it calls "particulates not otherwise regulated," which include gases, vapors, organic and inorganic dust.

Experts point to the 1997 NIOSH guidelines as the defacto standards for permissible fluid levels and to a 2001 OSHA best practices manual that "cites **ASTM International standards**, explains exposure monitoring, training, respiratory protection, machinery cleaning and draining, and other programs devised to reduce potentially harmful exposure."

It's in the exposure level guidance that the guidelines are different from the regulatory bodies' standard. NIOSH advises that exposure to metalworking fluid aerosols be limited to 0.4 mg/m³ of air (thoracic particulate mass) or 0.5 mg/m³ of air (total particulate mass), as a time-weighted average concentration up to 10 hours per day during a 40-hour workweek.

For detailed information on coolants and common metalworking fluids, read "A Guide to Machine Lubrication: Find the Right Water Coolant Type".

Meanwhile, workplace advocacy groups would like to see changes made to the OSHA standards and have filed a lawsuit petitioning that the government raise permissible fluid exposure levels. The courts have ruled, so far, that there is not enough scientific proof to require the change. In 2004, the U.S. Court of Appeals **concluded**: "While there is little debate about the link between metalworking fluid exposure and respiratory disorders and dermatitis (again, the debate is over the severity and prevalence), the evidence supporting a connection to cancer is equivocal."

The utility of metalworking fluids in the right amounts under the right control is considered safe by many. Incidents involving fluid exposure have not risen to the level of injuries and fatalities associated with falls, hazard communications, machine guarding, and lockout/tagout. Even so, hazard evaluation is still a major part of the OSHA standard for respiratory protection, which OSHA has identified as a top 10 violation—**ranking No. 4 on the 2017 list**, with over 3,000 violations.

OSHA Section 1910.134(d)(1)(iii) notes that: "The employer shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of employee exposures to respiratory hazard(s) and an identification of the contaminant's chemical state and physical form. Where the employer cannot identify or reasonably estimate the employee exposure, the employer shall consider the atmosphere to be IDLH (immediately dangerous to life or health)."

Unsure what to do about coolant waste and foul-smelling fluids in the sump, check out "4 Tips to

Optimize Machine Maintenance and Coolant Disposal."

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Dr. Fred Passman

President, BCR Inc., and Chairman, ASTM E.34.50 Health and Safety of Metalworking Fluids Subcommittee

As with All Safety Regulations, Follow OSHA's Guidance

NIOSH may have guidance on permissible levels to follow, but it always pays to understand and follow what the regulator in charge advises.

OSHA, with consensus guidance from ASTM, *recommends that manufacturers* follow engineering and work practice controls, use the right PPE, establish a metalworking fluid management program and where necessary, implement exposure and medical monitoring programs. Further, in addition to training workers about fluid use, OSHA suggests, that companies:

- Designate someone to have overall responsibility for fluid management
- Draft written standard operating procedures for testing fluids
- Create data collection and tracking systems customized and prioritized to each facility and that monitors factors such as concentration, pH, foaming tendency, biological contamination and other issues

The Safety Evolution of Metalworking Fluids

Metalworking fluids, often abbreviated as MWFs, produce a mist which can harm the respiratory system when someone is exposed to unhealthy amounts, hence the need and use of *mist collectors*. In addition, there is the potential for fluids to come in to contact with workers' skin during metal finishing work—though protective guards, gloves, eyewear and proper hygiene can mitigate that risk, experts find.

The good news is that the chemical compounds used in today's fluids have come a long way—and when engineering controls, protective equipment and industry guidelines are followed, worker safety goes way up. But all these things need to work harmoniously together.

"There's an oft-cited statement in toxicology from the chemist Paracelsus that effectively translates to: 'It's the dose that makes the poison,' " says Passman, who also chairs the ASTM E.34.50 Health and Safety of Metalworking Fluids Subcommittee and has had an industry focus on the subject since 1982.

"The fluids have changed dramatically since the '70s and '80s," Passman says. "And people have gotten smarter about long-term dermal exposure using commonsense, daily hygiene such as not wearing the same the uniforms for days on end, using gloves where feasible and working with more machines that are enclosed."

How does your shop protect against the potential harmful effects of metalworking fluids? Share your experience here.