



UKLA Metalworking Fluid Product Stewardship Group

TOPIC REVIEW 8: Volatile Organic Compounds and Metal Working Fluids

Introduction: The increasing use of chemical products emitting Volatile Organic Compounds (VOCs) in machine shops and small workshops raises occupational health concerns. This review explores the definitions, characteristics, and health risks of individual VOCs and the combined Total VOC (TVOC) exposure from work with metalworking fluids in machine workshops. It discusses exposure circumstances and the reported health and toxicological effects of VOCs. The review also considers the effectiveness of current sampling and analytical methods used to quantify personal exposure, as well as the control measures used to reduce VOC emissions.

Research Methods: Academic search engines (Semantic Scholar™, PubMed™, and Google Scholar™) and Google search were used to identify publications, technical reports, and regulatory guidance from 1990 to 2026. The studies included systematic reviews, single studies, and guidance documents, with eighty-nine relevant sources that addressed VOC emissions and health impacts from work with MWFs or other occupations, and that examined the toxicological and health effects of exposure to VOCs.

Main Findings: Thousands of VOCs differ in chemistry, volatility, and their response to temperature, affecting airborne concentrations, absorption into the body, and subsequent toxicity and health effects. Certain VOCs, such as aromatic hydrocarbons and halogenated compounds, are particularly toxic. Water-mix MWFs contaminated with bacteria and fungi also release Microbial VOCs (MVOCs), which may pose a health risk. The evidence about occupational VOC exposure and health risks is based on cross-sectional and case-control studies, with few longitudinal cohort studies, making causation difficult to determine. These studies often used proxy measures, such as job title, to estimate exposure. Furthermore, understanding the health effects of VOC mixtures is complex. VOC exposure in machinists has been linked to increased risk for airway inflammation, asthma, and chronic obstructive pulmonary disease.

Discussion and Analysis: The review highlighted occupational health risks from VOC exposure, including respiratory and neurological effects. Historical concerns about carcinogenic risks from impurities in lubricant oils have been minimised in recent decades with the greater use of highly refined oils and the restriction on the use of potential carcinogenic substances in formulating water-mix MWFs. Continuing to reduce VOC emissions through chemical substitution, improved ventilation, extraction, and enclosure will help to further minimise health risks for machinists. The health effects of MVOC emissions are not well understood but can be mitigated by managing MWF quality.

Conclusion and Knowledge Gaps: The review identified the need to improve methods for monitoring and quantifying exposure to TVOCs in machine workshops, and for monitoring acute and chronic health effects. More evidence is needed about the impact of different control measures to reduce VOC emissions to improve factory air quality.