Real-Time Monitoring Helps Auto Manufacturer Manage Oil Mist Exposure

Application Note EXPMN-021 (A4)

Introduction

Machine shops use metalworking fluids to lubricate, cool, and remove metal cuttings from the parts being machined. These fluids can be aerosolized as mist. “Metal working fluids can cause adverse health effects through skin contact with contaminated materials, spray, or mist and through inhalation from breathing metal working fluid mist or aerosol.”[1]

[1] Metalworking Fluids: Safety and Health Best Practices Manual, OSHA.

Situation

Metalworking fluids vary based on the process. These fluids can be oil based or water based. Additives are used to increase lubrication, prevent corrosion, and reduce degradation.

The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for mineral oil mist is 5 mg/m^3. The PEL for non-oil based mist without other toxic components is 15 mg/m^3.

The National Institute for Occupational Safety and Health (NIOSH) published a Recommended Exposure Limit (REL) of 0.4 mg/m^3 for thoracic particulate mass (10 microns and smaller) which equates to approximately 0.5 mg/m^3 for total particulate mass. [1]

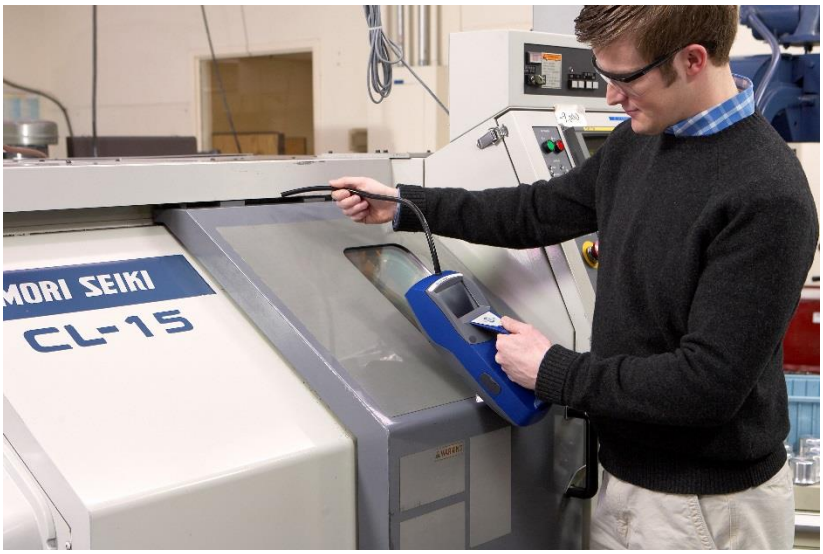
To prevent respiratory system problems associated with metalworking fluid exposure, companies implement controls to keep employee exposure below the recommended guidelines. Regular air monitoring is needed ensure the controls are working to control exposure.

Air monitoring involves a PVC filter in a cassette, connected by flexible tubing to a battery operated pump on the worker's belt. The cassette is mounted near the worker's mouth to collect a sample of anything that comes into the worker's breathing zone. The pump is calibrated to draw a specific flow rate of air. Notes are taken on when the pump is turned on and off. The total volume of air is calculated by multiplying the run time by the pump flow rate.

When sampling is complete, the filter media is sent to a lab to be analyzed for the content and mass of material collected during the sampling time. Lab results are typically received a week to ten days after sending in the sample. This process takes a lot of time to conduct and the employee exposure levels are not known until the results are received from the lab.

Solution

A US automobile manufacturer uses the TSI DustTrak™ Aerosol Monitor to monitor airborne concentration levels of metalworking fluid mist in real time.



The DustTrak™ Aerosol Monitor is a light-scattering, photometric aerosol mass concentration instrument. The DustTrak™ instrument provides a precise, repeatable, real-time measurement of aerosol mass concentration based light scattering properties of a known test aerosol. Because the properties of the test dust used to calibrate the DustTrak Aerosol Monitor are very different from the metal fluid mist, the DustTrak Aerosol Monitor measurement will not match the lab results. However, photometric calibration factors can be developed that will adjust the DustTrak Aerosol Monitor response to more closely align with gravimetric sampling results.

This automobile manufacturer has used the DustTrak™ Aerosol Monitor side-by-side with sample pumps to develop photometric calibration factors for various cutting fluids. They have calibration factors for each cutting fluid and each tool. Having these photometric calibration factors developed for their processes, the industrial hygienist can easily sample areas and spot check equipment to ensure aerosol concentration levels remain below the guidelines. Measuring the aerosol concentration in real time enables the industrial hygienist to immediately identify any exposure control issues that needs to be addressed. After engineering control changes are made, a quick spot check with a DustTrak™ Aerosol Monitor verify the changes reduced the metal fluid mist concentration below the recommended limits.

Doing the monitoring with filter-based sample pumps would take more than a week, and another week to determine if the changes reduced the aerosol concentrations below the guidelines

Conclusion

A direct reading, aerosol mass concentration instrument with calibration factors developed for the specific aerosols is the fastest way to ensure ongoing exposures are controlled.

Light scattering, photometric aerosol mass concentration instruments, like the DustTrak™ Aerosol Monitor, are valuable tools for quickly identifying aerosol mass concentration levels. These instruments provide aerosol mass concentration levels during the activity, instead of waiting several days for lab results.

Knowledge Beyond Measure.

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