

## Evaluation of Soluble Oil vs. Semi-Synthetic Metal Working Fluids at Toolamation Inc.

By: Malcolm Boyle

Toolamation Inc. collaborated with technical assistance specialists from the University of Illinois Sustainable Technology Center (ISTC) to evaluate the metal working fluid (MWF) oil removal system and soluble-oil vs. semi-synthetic MWFs.

### Background

Toolamation Inc. (<http://www.toolamation.com/>), founded over 40 years ago by Marlin Bird, is a privately owned and operated Illinois metal working business in Beach Park, IL that employs 40 people. Toolamation provides high-volume automated production broaching and screw machine tooling products. Other services include heat temperature, tumbling/deburring, CNC machining, and EDM services. They specialize in high quality parts fabrication with fast setup and turnaround. Toolamation is ISO 9001 certified.

Toolamation was contacted by ISTC engineers to determine their interest in participating in the Cutting Edge Partnership, a program to assist metal working facilities with MWF related issues, as well as pollution prevention (P2) and energy efficiency (E2) improvements. Marlin Bird was interested in assistance with their soluble-oil MWF.

### MWF Evaluation



Figure 2

Toolamation was using a soluble-oil fluid in their Okuma Milling Machine (Figure 1). There were so many tramp oils floating on the MWF in the machine's sump that the fluid appeared black (Figure 2). Tramp oils are generated as a byproduct during metal working operations, either from machined parts or hydraulic leaks. Tramp oils that accumulate in the MWF act as a nutrient source for bacteria, causing the MWF to degrade and produce offensive odors.

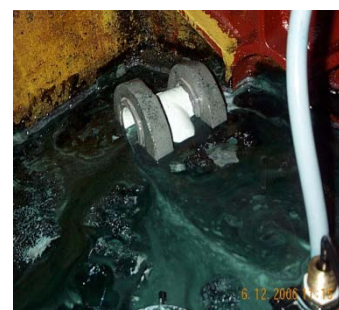


Figure 1

A tramp oil removal system from Solvent Systems International (<http://www.solvent-systems.com/index.htm>) was installed (Figure 3). The floating tramp oils were immediately removed from the soluble-oil MWF (Figure 4) so the tramp oils did not have time to emulsify in the MWF, which would contaminate the fluid and provide additional nutrients to support bacteria growth. During continued pilot testing, the tramp oil removal system kept the tramp oils from collecting on the MWF, but the soluble-oil fluid was still going rancid in about 6 weeks. The smell was intolerable even after adding "Coolant Mints" to control the odor by neutralizing the hydrogen sulfide gas emitted by the bacteria. The cost associated with the MWF was insignificant compared to the loss of machine time and productivity due to the required time to drain, clean, and recharge the mill sump. It took about a day to clean the Okuma, replace the MWF, and get the machine back to production.



**Figure 3**

A vendor with many years of MWF experience, Anders Kausrud (akausrud@stnr.com), Crown Industrial Supply Company, suggested that they use a semi-synthetic MWF (Q-Cut 251 from QualiChem, Inc.; <http://www.qualichem.com/>).



**Figure 4**

The cost of the semi-synthetic MWF is about two and a half times more than the soluble oil MWF. But it would pay for itself if it eliminated the need for shutting down the milling machine every six weeks (not taking into account the disposal cost of the soluble-oil). The Q-Cut 251 has performed for 42 weeks to date, with additions to make up for the MWF lost on the machined parts. This is seven times longer than the soluble-oil MWF and the operator does not notice any rancid smell.

Bacteria dip slides are being used to monitor the bacteria count in the MWF. The bacteria count has ranged from zero to 10,000 bacteria/mL for the semi-synthetic. These slides are very subjective and only monitor certain bacteria, but it does give an indication of the bacteria growth. The bacterial reading was greater than 10,000,000 bacteria/mL when using the original soluble-oil MWF.

## Benefits

The most significant benefit of changing from soluble-oil MWF to semi-synthetic MWF for Toolamation is the reduction in the number of times the Okuma Milling Machine has to be taken out of production to replace the MWF. Ancillary benefits are the cost savings associated with using the semi-synthetic MWF longer (\$500/year, purchasing & disposal) and the reduction in odor coming from the MWF.

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