

# Introduction to Metalworking Fluids (MWFs) for Solicitors

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# Issues Covered

- What are metalworking fluids (MWFs)
- Types of MWFs
- Lubricants market size (UK)
- Exposed population estimates
- Outbreaks of disease associated with MWF exposure
- Management of MWF
- HSE Focus 2022/2023

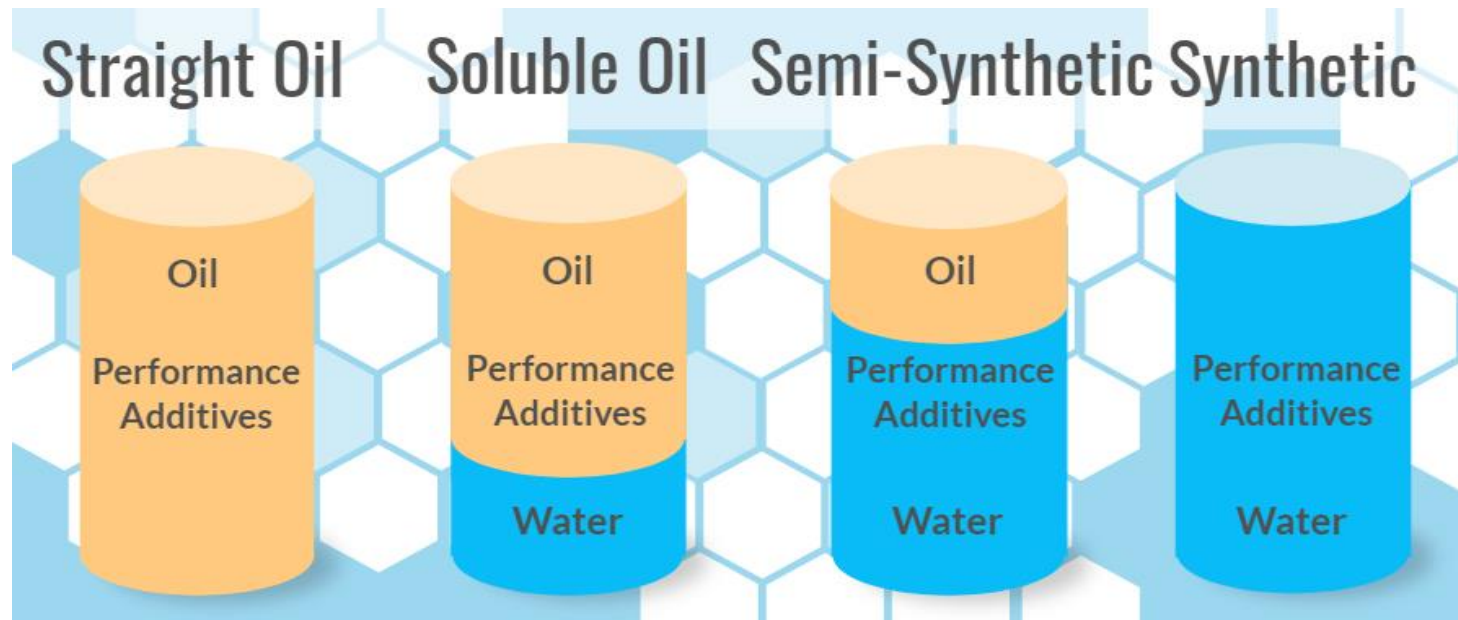
# Summary

- The number of workers using Metal Working Fluids (MWFs) is increasing
- There is a increase in the global market usage of metalworking fluids (MWFs)
- General awareness of the diseases associated with MWF is increasing
- MWFs can cause Extrinsic Allergic Alveolitis (EAA), also known as Hypersensitivity Pneumonitis (HP) and Occupational Asthma (OA)
- Potential increased risk of cancer associated with exposure to MWF, especially to straight oils<sup>1</sup>
- There is no one specific test to diagnose (EAA)

# What are Metalworking Fluids (MWFs)

- Metalworking fluid (MWF) is the name given to a range of oils and other liquids that are used to cool and/or lubricate metal workpieces when they are being machined, ground, milled, etc.
- They are sometimes referred to as 'suds'
- MWFs reduce the heat and friction between the cutting tool and the workpiece, and help prevent burning and smoking.
- Applying MWFs also helps improve the quality of the workpiece by continuously removing the fines, chips, and swarfs from the tool being used and the surface of the workpiece.

# Types of Metalworking Fluid (MWF)



1)

Oil-based:

- insoluble
- soluble (30% - 85%)

2)

Water-based

- semi-synthetic (5% - 30% oil)
- synthetic (no oil)

Source: [www.chempoint.com/insights/henkel-bonderite-machining-fluids-101](http://www.chempoint.com/insights/henkel-bonderite-machining-fluids-101)

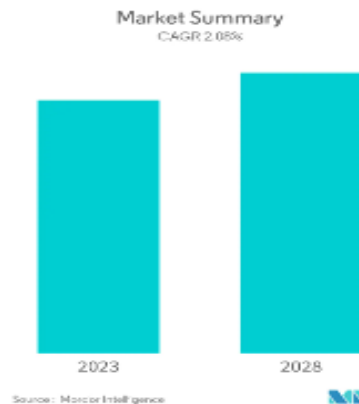
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# MWF User Industries

- Metal fabrication/engineering
- Automotive
- Medical technology
- Construction
- Aerospace
- Marine
- Transportation equipment

# UK Lubricants Market Size



 Study Period:	2015 - 2026
 Largest Share by End User:	Automotive
 Fastest Growing by End User:	Heavy Equipment
 CAGR:	2.08 %

## Major Players



ExxonMobil

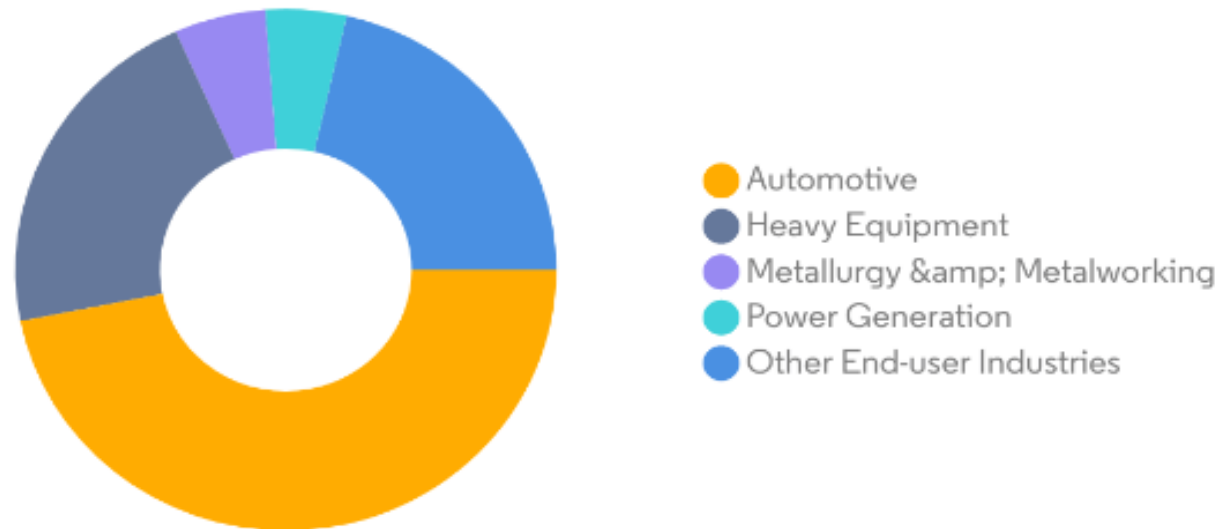


\*Disclaimer: Major Players sorted in no particular order

- 390.1 million litres in 2021
- Project CAGR of 2.08%
- Equating to 432.4 million litres in 2026
- 2020, automotive sector dominated the market and accounted for 46.85% of the total lubricant consumption.

# UK Lubricants Market, Volume Share by End User in 2020

United Kingdom Lubricants Market, Volume Share, By End User, 2020



Source : Mordor Intelligence



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# UK Lubricants Market Leaders

- 1 BP Plc (Castrol)
- 2 Exol Lubricants Limited
- 3 ExxonMobil Corporation
- 4 Royal Dutch Shell Plc
- 5 TotalEnergies

\*Disclaimer: Major Players sorted in no particular order

## Market Concentration



Source: Mordor Intelligence

# UK Exposed Population Estimate

- The HSE estimates that there are between 100,000 and 200,000 workers that are exposed to MWFs.
- Workers can be exposed to the MWFs in the following ways:
- **Respiratory Exposure** – occurs via inhalation of the mist generated by machining process and can also occur from the use of compressed airlines by workers when cleaning machined components.
- **Skin Exposure** – through contact with MWF when handling fluid laden parts.
- **Ingestion** – hand and mouth contact from eating, drinking and smoking in work areas as a result of poor hygiene practices.

# UK Outbreaks of Disease

- 3 main outbreaks of EAA in Birmingham, Yorkshire and Nottingham at factories where workers were exposed to mists from MWF.
- HSE concluded MWF exposure was responsible for the Birmingham outbreak.
- Information from the HSE in May 2006 indicates that in the Nottinghamshire outbreak, there were confirmed cases of OA and EAA and estimated a total of 13 cases after clinical investigations.
- Analysis of the MWF from the 3 outbreaks showed the presence of microbial contaminants.

# Longbridge Powertrain Plant Outbreak

- First major outbreak was investigated by the HSE in June 2005.
- The site constructs engines for car industry
- Diagnosis of 12 cases of EAA in workers in 2003-2004
- Out of total workforce of 836;
- 87 workers met case definitions for occupational lung disease.
- 19 cases of EAA
- 74 cases of OA.
- 79 claimants with settlements ranging from £550 - £180,000

# Global Outbreaks of Disease

- 29 outbreaks of ill health associated with MWF
- Microbial contamination was suspected but no unifying causative agent could be found.
- Powertrain database was created at the time of the outbreak and was used by 5 lung disease consultants who concluded 14 workers as definite cases of OHP.
- WATCH (Working Group On Actions to Control Chemicals) Meeting June 2007 – Review published studies, papers and reports from around the world referring to outbreaks of disease amongst MWF workers.

# Literature Review – WATCH June 2007

**Table 9: Summary of incident investigations of respiratory ill health**

Year of initial case	Country	Industry	Workforce	Exposed workers	MWF aerosol levels	Type of MWF used	Ref
1983	UK	Aeronautical	NA	NA	Oil mist 0.66 mg/m <sup>3</sup>	Soluble/water mixed, neat	261 278
1992	USA	Automobile	NA	16	NT	Synthetic	279
1994	USA	Automobile (3 sites)	NA	NA	NT	Soluble	287
1995	USA	Automobile	1,592		Oil mist mean 0.8 mg/m <sup>3</sup> , total particulate mean 1.0 mg/m <sup>3</sup> (<REL)	Synthetic	1
1995	USA	Automobile	1600	800	Oil mist < REL 3 PBZ > REL	Synthetic, soluble/water mixed	288
1996	USA	Automobile	NA	265	0.08-1.17 mg/m <sup>3</sup>	Soluble/water mixed, semi synthetic	289
1997	USA	Aeronautical	1600	80	20/21 < REL	Soluble/water mixed	290
1997	USA	Firearms	1100	450	39 samples for oil mist. Mean 0.66 mg/m <sup>3</sup>	Semi synthetic	291
1997	USA	Aeronautical	120	105	All < REL	Neat oil, soluble/water mixed, semi synthetic, synthetic	292-294
1997	USA	Automobile	1000	338	0.09-0.38 mg/m <sup>3</sup> 5 out of 9 >REL	Soluble/water mixed, semi synthetic neat oil,	295
1999	USA	Automobile (3 sites)	700	NA	0.33-1.29 mg/m <sup>3</sup> NT	NT	296
1999	USA	Automobile	462	250	4 out of 70 μ REL	Semi synthetic	297
2000	USA	Automobile	400	150	0.059-3.5 mg/m <sup>3</sup>	Semi synthetic	298-300
2000	USA	Automobile	2000	NA	All but 1 < REL	Semi synthetic	301 302
2003	USA	Automobile (3 sites)	942(mean)	NA	All < REL	Semi synthetic	303
2003	UK	Automobile	836	NA	Generally < HSE guidance	Soluble/water mixed	260 281
2005	UK	Small component manufacture	<50	21	NT	Soluble/water mixed	304

**Note:** REL = recommended exposure limit set by NIOSH.

\*NIOSH recommends a REL MWF aerosol of 0.4 mg/m<sup>3</sup> thoracic particulate (the proportion of the aerosol that penetrates below the larynx in the respiratory system) as a time weighted average (TWA) concentration for up to 10 hours per day during a 40 hour week. Measurement of total particulate is an acceptable substitute for measuring thoracic particulate and the NIOSH REL is 0.5mg/ m<sup>3</sup> 257.  
HSE guidance for MWF concentration in air: 1mg/m<sup>3</sup> and for mineral oil mist in air: 3mg/m<sup>3</sup> 259 263.

# Poor Management of MWF

- It is a general consensus that MWF management has been found to be of a poor standard with high levels of bacteria, endotoxins and metal fines in the sump in some cases.
- Control of other factors such as concentration was also poor.
- A number of papers have discussed the potential increased risk of cancer associated with exposure to MWF, especially straight oils.
- Significant associations have been made between straight oil exposure and an increase risk of bladder, oesophageal, laryngeal, colon, rectal cancer and malignant melanoma.

# Metalworking Fluid Management

- Refers to not keeping certain conditions of the fluid within manufacturer's requirements and allowing a build-up of contaminants.
- By not maintaining the MWF correctly can cause an increase of contaminants and importantly result in increased aerosolization of the MWF into a mist (Wang et al 2005).
- Wang et al 2005 demonstrated that increased microbial contamination of MWF doubled the concentration of mist.
- Wang et al 2005 further demonstrated that the use of a machining tool at higher rotational speeds caused break down of bacterial cells. This resulted in the aerosolization of smaller particles which can penetrate deeper within the respiratory system.



# Metalworking Fluid Management

- Based on guidance from the HSE (MW5), MWF should be maintained using the following basic parameters that involve undertaking checks on a regular basis.
  1. MWF Concentration
  2. MWF pH
  3. Tramp oil
  4. Metal contamination
  5. Operating temperature
  6. Agitation & flow
  7. Biocides

# HSE Work Plan 2022/2023

- HSE Overall Strategy: reduce work-related ill health

## **Fabricated Metal/Engineering**

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### Health Focus

- Metalworking Fluids
- Weld Fume



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