



BERPC

Bureau d'évaluation
des risques des produits
et agents chimiques

Occupational exposure to biocides in metalworking fluids



HEEG opinion,
agreed at TM IIII08

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OSLO, 24 February 2009

Description of the application : Use of metalworking fluids

- Why?
Lubricating, cooling and
carrying cuttings
- How?
by continuous jet, spray, or
hand dispenser



Description of the application :

Use of biocides in MWF

- Why?
Prevent bacterial contamination
- How?
In MWF concentrates
Tank-side additive

Main health risks from MWF

Skin

Irritation or dermatitis

Respiratory system

Asthma, irritation, allergies

caused by :

- bacteria;
- metallic sensitising agents (from tools);
- metallic particles (from objects).
- chemicals (e.g. biocides);

Cancer

In the past (unrefined mineral oils)

Today, the risk of cancer is reduced



www.hse.gov.uk/metalworking

Exposure scenarios : Inhalation

- Vapours (if volatile substance)
 - During loading of the product
 - During application of the MWF
- Aerosol / Mists
 - During application of the MWF
(generated during machining operations)

Exposure scenarios : Dermal

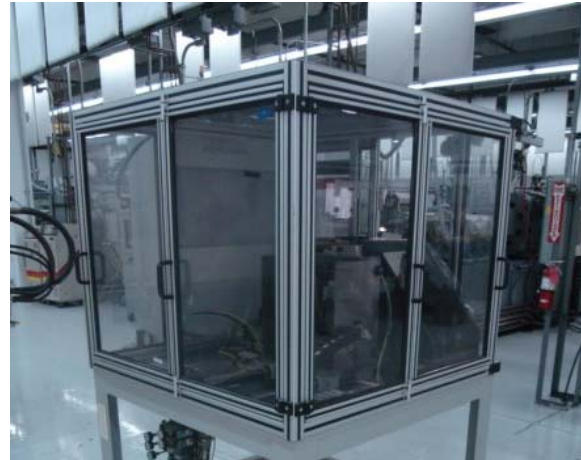
- from the product (loading)
- from MWF (application and post-application)
 - Splashes during machining
 - Handling of worked pieces
 - Changing and setting of tools, and
 - Maintenance and cleaning operations

Exposure scenarios : Oral

- Hand-to-mouth transfer
e.g. eating or smoking with soiled hands
Not to be considered for trained professionals

Measures to prevent / reduce the exposure

- Collective
 - Enclosure
 - Ventilation
 - Splash guards



➤ Efficient but not always used

Measures to prevent / reduce the exposure

- Individual

- Coveralls

- Cotton or impermeable

- Gloves

- ⚠ Hazardous if worn near rotating machinery

- Barrier creams

- Reduce irritation but do NOT prevent exposure



Exposure scenarios : assumptions

- Harmonised assumptions proposed by the HEEG and agreed at TMIII08
 - Exposure varies between practices and machines: e.g. degree of automation and collective protections.
 - Assumptions aim to
 - represent a « realistic worst-case » and
 - enable exposure calculations with available models
 - Videos showing fully manual vs fully automated machines:
<http://www.youtube.com/watch?v=t2wL9drAkIE>
<http://www.youtube.com/watch?v=rju3ly6nji0>

Exposure scenarios : assumptions

- **Mixing and Loading**

- Volume of poured product depends on concentrations
- Volume of the sumps: variable, up to 100 m³
- Duration and frequency: variable, default: 10 minutes, daily to monthly
- PPE: chemical-resistant gloves, coveralls and goggles, RPE (depending on label and FDS recommendations)

Exposure scenarios : assumptions

- **Application – inhalation exposure**
 - Inhalation exposure is continuous in the workshop (air contaminated with aerosols and vapours).
 - duration : 6-8 hours per day (one full shift)

Exposure scenarios : assumptions

- **Application – dermal exposure**
 - Direct handling :
 - 1 hour, high exposure, bare hands
 - Other daily tasks (e.g. disposal, cleaning):
 - 5-7 hours, medium exposure, with gloves (tier 2)

Exposure scenarios : assumptions

- **Post-application and Ancillary (secondary) tasks**
 - Daily tasks (e.g. cleaning, swarf disposal): included in application
 - Sump maintenance: 4 hours 1/month,
 - Fluid monitoring: 10 minutes 1/week,
 - Other tasks

Available models

- **Mixing and Loading**

- HEEG recommendations on loading models agreed at TM I08 :
- Manual loading => EUROPOEM II (gives mg/kg values)
- Automated : RISKOFDERM 'connecting lines'

Models and calculations

- **Application (+ daily tasks)**

- BEAT's worked example for PT13 gives :

- hands under gloves: 46 mg/min

from Roff M., (2004a) but NOT reliable
NO other model available

- body: 92 mg/min

from Roff M., Bagon D., Chambers H., Dilworth M., Warren N. (2004a)
OK

- inhalation: 0.33 mg/m³

from MWF model 2 = HSE report 74/4
OK

Models and calculations

- **Application – Hand exposure**
 - **Solution proposed by HEEG :**
 - **Direct handling : 200 mg/min,
i.e. 12 ml (6ml per bare hand) for 1-hour**
 - **Other tasks : 8.71 mg/min,
from Handling model 1 (under gloves)**

Models and calculations

- **Post-Application (other than daily tasks)**
 - Sump maintenance and fluid monitoring
 - Inhalation : like application
 - Dermal : BEAT's models
 - ✓ Timber pretreatment (Handling model 1) or
 - ✓ Cleaning of spray equipment

Calculations : example

Task / Scenario :	Loading
Model used :	EUROPEOM II

	Tier 2
Body dermal exposure	
clothing type	impermeable coveralls
indicative value from model	1,95 mg/kg
poured mass	25 kg/event
potential dermal deposit	48,8 mg/event
clothing penetration	5%
actual dermal deposit (product)	2,44 mg/event
Hands dermal exposure	
gloves worn	yes
indicative value from model	8 mg/kg
poured mass	25 kg
potential dermal deposit	200 mg/event
gloves penetration	10%
actual hand deposit (product)	20,0 mg/event
Exposure by inhalation	
RPE worn	no
indicative value from model	0,003 mg/kg
poured mass	25 kg
inhaled product	0,075 mg/event

Depends on dilution

Calculations : example

Task / Scenario :	Application (Operating + daily tasks)
Model used :	body : BEAT Machining metal parts (HSL) Roff et al 2004 hands : default 6 ml spill on a bare hand inhal : Metal working model 2, HSE report EH 74/4

	Tier 2
Body dermal exposure	
clothing type	cotton coveralls
potential expo from model	91,6 mg/min
duration	480 min/day
potential dermal deposit	43968 mg/day
clothing penetration	25%
actual dermal deposit (MWF)	10992 mg/day
Hands demal exposure	
<u>direct operating</u>	<u>without gloves</u>
potential expo from model	200 mg/min
duration	60 min/day
actual hand deposit 1 (MWF)	12000 mg/day
<u>other tasks</u>	<u>with gloves</u>
actual expo from model	8,71 mg/min
duration	420 min/day
actual hand deposit 2 (MWF)	3658 mg/day
total hand deposit 1+2 (MWF)	15658 mg/day
Exposure by inhalation	
indicative value from model	0,33 mg/m3
duration	480 min/day
inhaled product (MWF)	3,3 mg/day

Result from van Wendel de Joode :
Expo to hands+forearms, mostly with gloves
GM = 1354 mg/day (full shift)
75%ile = 4275 mg/day
95%ile = 22357 mg/day

≈ 92%ile
=> « reasonably conservative »

An assessment of dermal exposure to semi-synthetic metal working fluids by different methods to group workers for an epidemiological study on dermatitis

B van Wendel de Joode, E P B Bierman, D H Brouwer, J Spithoven and H Kromhout

Occup. Environ. Med. 2005;62:633-641
doi:10.1136/oem.2004.015396

Calculations : example

Task / Scenario :	Sump maintenance
Model used :	body and hands: BEAT Cleaning of spray equipment inhal : Metal working model 2, HSE report EH 74/4

	Tier 2
Body dermal exposure	
clothing type	cotton coveralls
Indicative value from model	19,2 mg/min
duration	240 min/day
potential dermal deposit	4608 mg/day
clothing penetration	25%
actual dermal deposit (MWF)	1152 mg/day
Hands demal exposure	
gloves worn	yes
Indicative value from model	35,8 mg/min
duration	240 min/day
potential dermal deposit	8592 mg/day
gloves penetration	10%
actual hand deposit (MWF)	859,2 mg/day
Exposure by inhalation	
indicative value from model	0,33 mg/m3
duration	240 min/day
inhaled product (MWF)	1,650 mg/day



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Thank you !