

Note to the file:

This Opinion is replaced by the Ad hoc Working Group on Human Exposure recommendation 7 "Professional exposure assessment to biocidal products used in metalworking fluids (PT 13)" agreed at the Human Health Working Group III on 2 June 2015.



Agreed in TM III 08

Ispra, 22/09/2008

**HEEG opinion
on Human exposure assessment to biocidal products
used in metalworking fluids (PT13)**

A discussion started between UK, SI and FR about how to address the exposure assessment for PT 13 biocidal products. It appears that some information from the TNsG on human exposure assessment needs to be completed, clarified and/or corrected.

This document aims at proposing a harmonized method and relevant data for the assessment of professional exposure to biocides in metalworking fluids.

This document was discussed within the Human Exposure Expert Group (HEEG) and is presented for discussion/endorsement to the Biocidal Technical Meeting (TM III 08, October 2008).

1) Task identification

Sources: *TNsG v1 (2002) part2 3.2 use pattern PT13, pages 105-107*
TNsG v2 (2007) use pattern (excel database) + 2.9 secondary exposure scenarios p.24

Hereafter are reported the tasks listed in the Technical Notes of Guidance.

1. **Mixing and Loading:** metalworking concentrate (containing a biocidal product) is diluted and added to the sump; or the biocidal product is added directly as a tank-side additive to the sump at the metalworking plant. Mixing and loading is generally done by automation but may be done manually.
2. **Application:** operating the machine, handling worked pieces, setting and dismantling the tool
3. **Post-application:** machine and sump maintenance, fluid monitoring
4. **Ancillary (secondary) tasks:** transfer of machined metal from lathe to storage area (automated or manually)

Additional tasks can be considered, e.g. shaving (swarf) disposal, cleaning of workshop surfaces, handling empty drums, home laundering of contaminated work clothes. Following expert judgment, related exposure can be estimated separately or considered as covered by other scenarios (e.g. application or mixing and loading).

Distinction between post-application and secondary tasks is not clear. The main difference is whether the exposed person is involved in the application (post-application) or not



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(secondary). In case-per-case basis, the exposure assessments can be done together or separately.

2) Assumptions for the exposure assessment

Sources: *TNsG v1 (2002) part2, 3.2 use pattern PT13, pages 105-107*
TNsG v2 (2007) use pattern (excel database)
BEAT's worked example for PT13 Machining of metal tool parts (cf Annex)
*Roff M., Bagon D., Chambers H., Dilworth M., Warren N. (2004a) **Dermal exposure to electroplating fluids and metal working fluids in the UK.** Annals of Occupational Hygiene (48) 209-217*
HSE report 74/4 (data partially reported in Ann. Occup. Hyg. Vol. 47, p.17-30, 2003 - Occupational Exposure to Metalworking Fluid Mist and Sump Fluid Contaminants. A. T. Simpson, M. Stear, J. A. Groves, M. Piney, S. D. Bradley, S. Stag and B. Crook)

1. Mixing and Loading

- Occurs during the formulation of the metalworking fluids (similar to PT6) or at metalworking plants (tank-side additive)
- Volume of poured biocidal product depends to its concentration, targeted biocide content in fluids and volume of the sump or blend tank
- Volume of the sumps: variable, up to 100 m³
- Duration and frequency: variable, default: 10 minutes, daily to monthly
- Exposure routes: dermal (mainly hands), inhalation if volatile substance
- PPE (Tier 2 or if recommended): chemical-resistant gloves, coveralls and goggles, RPE (depending on label and FDS recommendations)

2. Application

Duration and frequency:

For dermal exposure, distinction is done between metalworking itself and other tasks in the workshop:

- metalworking on turning machine: dermal exposure is important (direct contact with fluid + splashes) and gloves are NOT worn, exposure duration is 1 hour,
- other tasks in the workshop (maintenance, monitoring, cleaning, disposal and transfer): dermal exposure is lower (contact with contaminated surfaces), exposure duration is 4 to 7 hours (daily total)

Inhalation exposure is continuous in the workshop (air contaminated with aerosols and vapours). Therefore, exposure duration is 8 hours per day (one full shift).

PPE:

Wearing gloves near turning machine is NOT a common practice, due to dexterity and safety reasons (gloves could be caught in the turning machines)

Gloves can be assumed for other tasks (Tier 2 or if recommended)

Cotton (not impermeable) coveralls are typically worn

3. **Post-application** and

4. **Ancillary (secondary) tasks**

Duration and frequency:

- Sump maintenance: 4 hours 1/month,
- Fluid monitoring: 10 minutes 1/week,
- Other tasks: variable, but total should not exceed 8 hours per day.

Exposure routes: dermal (hands and body) and inhalation (possibly aerosol and vapour)

PPE (Tier 2 or if recommended): gloves, cotton or impermeable coveralls, and RPE (depending on label and FDS recommendations)

3) Indicative values for exposure estimates

1. **Mixing and Loading**

Refer to the HEEG recommendations on loading models agreed at TM I08.

loading_models_final
_circa.pdf

Double-click to open:

2. **Application (metalworking)**

BEAT's worked example for PT13 Machining of metal parts (see annex) gives following exposure values:

- hands under gloves (actual): 46 mg/min
- body: 92 mg/min
- inhalation: 0.33 mg/m³

Dermal exposure values come from Roff M., Bagon D., Chambers H., Dilworth M., Warren N. (2004a) **Dermal exposure to electroplating fluids and metal working fluids in the UK.** *Annals of Occupational Hygiene* (48) 209-217.

Contrary to body exposure value, actual hand exposure value is NOT reliable. The authors of the report concluded it because:

1. wearing of gloves is not a common practice (*"only one subject out of 25 observed actually wore gloves"* p.210),
2. little data are available (*"From the little data available for gloves hands (seven results from one subject)"* p.213),

3. the value is surprisingly high and may reflect a wrong usage of the gloves (*"this is a surprisingly high ratio given that the sampling gloves were worn beneath protective gloves. It indicates either that the protective gloves were themselves saturated or that they were removed from time to time, which would have allowed the sampling gloves to become wet"* p.213),
4. another sampling method would be more appropriate (*"In retrospect, we should have adopted a handwashing method for MWFs when gloves were refused, but no methodology was available on site at the time"*).

HEEG members (from TNO) are looking for reliable indicative data from another study (Van Wedel de Joode [2005]). The authors determined in metal working machining departments the dermal exposure via different methods. They compared the Roff data with their data and found a much lower value for potential hand exposure.

If no reliable model can be found, we propose to use the default 6 ml spill model which assumes 6 ml of fluid adhering to a bare hand, i.e. 12 ml on both hands per cycle, or 200 mg/min (based on 1-hour cycle). This default model is suggested in Metalworking fluids Model 1 (TNsG v1 part 2 p.189) and in TNsG's worked example for "Barnspray" (v1 part 3 p.74: *"This is about the maximal amount that can stick to the hands"*).

The inhalation value (0.33 mg/m³) for water-based fluids comes from HSE report 74/4 which indicative data are also reported in Annex 1 of TNsG v2 (p.70). For oil-based fluids, the value is 2.12 mg/m³. As fluids to be preserved are generally water-based, 0.33 should be used in most of the dossiers.

Conclusion

Recommended indicative values, provided no better model for hands exposure can be found:

- Body: 92 mg/min
- Hands (potential): 200 mg/min
- Inhalation: 0.33 mg/m³ (water-based fluids)

3. **Post-application**

4. **Ancillary (secondary) tasks**

No specific data model can be found.

It may be possible to use the same indicative values as for application, particularly for inhalation exposure in the shop.

Possible alternative models for dermal exposure, depending on the tasks, are:

- Handling model 1 (Timber pre-treatment): indicative data from BEAT for water-based fluids are 108 mg/min for body and 8.71 mg/min for hands under gloves,
- Cleaning of spray equipment (in BEAT): indicative data are 19.2 mg/min for body and 35.8 mg/min for hands (potential).

Other models, or theoretical estimation of the surface-to-hand transfer, can be used based on RMS expert judgment.

Annex:

BEAT's worked example for PT13: Metalworking fluids

Bayesian Exposure Assessment Toolkit

Databases Tools Help Quitter

Biocide worked examples

Assessment scenario Related scenarios Predicted whole body exposures

Scenario Machining of metal tool parts R&H

Scenario description
Exposure to water based lubricants during the machining of metal tool parts (such as drill bits).

Breakdown of job activities

Task_name	% time
Milling & Turning	100

Remove task Add task % of time

Product characteristics

What is the physical state of the in-use formulation? Liquid

In-use formulation characteristics Like water Properties

Task-specific exposure determinants

What is the extent of contact with contaminated objects? Not Specified

What is the frequency of contact? Not specified

Level of contamination of objects Not specified

What is the kinetic energy of the Milling & Turning process? High energy process

How far is the worker from the emission source? < 30cm (handheld)

Is it an automated immersion process? Not specified

What is the predominant orientation of work relative to the worker?

What pressure does the spray equipment operate at?

Assessment scenario Related scenarios Predicted whole body exposures

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Breakdown of job activities

Task_name	% time
Milling & Turning	100

Remove task Add task % of time

Work environment and control measures

The work environment is best described as: Indoor - large enclosures

What type of ventilation is present? General ventilation or inadequate LEV

Is the worker segregated from the primary source of exposure? None

Does the machinery have liquid based dust control? No

Personal protective equipment

Clothing type Dry cotton coveralls, 20% penetration

RPE type None

Glove type Suitable gloves, PF 10

Pattern of use

Daily exposure duration (minutes) 360

Assessment scenario | Related scenarios | Predicted whole body exposures

Scenario

Scenario description
 Exposure to water based lubricants during the machining of metal tool parts (such as drill bits).

Breakdown of job activities

Task_name	% time
Milling & Turning	100

% of time

Frequency of events per week

Number of weeks per year

Physiological parameters

Bodyweight

Respiration rate

Indicative Exposures

Dermal exposure hands (potential ul/min)

Dermal exposure hands (actual ul/min)

Dermal exposure body (potential ul/min)

Inhalation exposure (ul/m3)

Data sources:

Assessment scenario | Related scenarios | Predicted whole body exposures

Scenario

Scenario description
 Exposure to water based lubricants during the machining of metal tool parts (such as drill bits).

Breakdown of job activities

Task_name	% time
Milling & Turning	100

% of time

Data sources:

Potential body and actual hand exposures 75th percentiles from HSL study (Roff et al 2004a). Inhalation exposure is the 75th percentile of the data set presented in Annex 1 of TNSG v2 (HSE report EH74/4).

Active substance

Active substance

% dermal absorption

NOAEL mg/kg/day

Concentration of a.s., in-use formulation