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JOINT RESEARCH CENTRE

Institute for Health and Consumer Protection
Chemical assessment and testing

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HEEG opinion on Exposure model Primary exposure scenario – washing out of a brush which has been used to apply a paint

This document was prepared by UK in cooperation with HEEG.

Background

Cleaning (i.e. washing out) of a brush is not covered by any of the models in the TNsG on Human Exposure to Biocidal Products. To attempt to estimate the potential exposure to the skin of hands during this activity, a worst-case scenario has been assessed. This exposure scenario will usually be used for application of non-water-based paints because for water-based paints, the brush will often be cleaned under a running tap; the running water washing both the paint from the brush and any contamination from the hands. In the following worked example it is assumed the paint has a density of 1 g/ml. The model can also be used for paints having a density of less than or greater than 1 g/ml; by changing the value of the density of the paint accordingly. In the worked example, it is assumed the dermal absorption of the a.s. is 2 %. (*In their calculations, Assessors will need to use the dermal absorption value relevant to the a.s. under consideration*).

Model

Cleaning the brush used for applying paint may be done by repeated dipping and swilling it in a vessel containing an appropriate solvent. A large brush might have a size of 10 x 10 x 2 cm, corresponding to a volume of 200 ml. It is assumed that after painting one eighth ($\frac{1}{8}$) of the brush volume is paint. Cleaning is assumed to be done in three steps, each time using fresh solvent. The volume at each step should be large enough to allow a sufficient dilution of the residues in the brush. For a brush having a volume of 200 ml the volume of the cleaning solvent would be at least 400 ml per step. Each washing step is assumed to result in an approximately 10-fold dilution of the residues in the brush (i.e. 10

% of the paint originally on the brush remains after one washing). After each step the brush is assumed to be squeezed by the hand to get rid of as much solvent as possible. It is assumed that with this step 50% of the solution in the washed brush is released and may potentially contaminate the hand. However, it is further assumed that the squeezing is not done by the bare hand but rather by wrapping it first with a cleaning rag, which absorbs 90% of the released liquid. It is assumed the brush is washed and squeezed for a maximum of 3 times.

It is emphasised, the described exposure scenario for washing out a brush reflects a worst-case situation which assumes all contamination remains on the hands at the end of the activity and is available for dermal absorption.

The relevant parameters used in the worked example are summarised as follows:

A = Brush size : 10 x 10 x 2 cm (large brush)	200 ml
Volume of paint remaining in brush after painting	$\frac{1}{8}$ of A = 25 ml
Density of paint	1 g/ml
Weight of paint remaining in brush after painting = volume of paint remaining on brush after painting (ml) x density of paint (g/ml) <i>(N.B.: In this worked example the density of the paint is assumed to be 1 g/ml. If the density of the paint being assessed is not 1 g/ml then, its density will need to be included in the conversion of volume to weight).</i>	25 ml x 1 g/ml = 25 g
Volume of each washing solution	at least 400 ml
Percentage of residues remaining in brush after each washing step	10%
Following each washing step, percentage of residues remaining in brush after squeezing	50%
Concentration of active substance (a.s.) in the paint	1.4% w/w
Percentage of residues absorbed by cloth	90%
Penetration through gloves	10%
Dermal absorption. <i>(The appropriate dermal absorption value to be used will be determined by the toxicology of the a.s./paint being assessed).</i>	2%
Adult body weight (includes females)	60 kg

In the Worked Example on page 3, the systemic dose is calculated as indicated.

Activity and Parameters		Absorbed Dose	
		Tier 1 No gloves	Tier 2 Gloves
Volume of brush	200 ml		
Volume of paint remaining on brush after painting	$\frac{1}{8}$ of 200 ml = 25 ml		
Density of paint	1 g/ml		
Weight of paint on brush after painting = volume of paint remaining on brush after painting (ml) x density of paint (g/ml).	25 ml x 1 g/ml = 25 g		
Weight of a.s. on brush after painting	25 g x 1.4/100 = 350 mg		
Residues of a.s. on brush after 1st washing		10% of 350 mg = 35 mg	
Amount of a.s. removed from the brush into the cleaning fluid = 350 mg – 35 mg = 315 mg			
Weight of a.s. squeezed out from brush onto cloth	50% of 35 mg = 17.5 mg		
Cloth absorbs 90% of a.s. squeezed out of brush therefore, weight of a.s. available to contaminate the hand	10% of 17.5 mg = 1.75 mg		
Penetration of a.s. through gloves	10%		
Weight of a.s. on hand		1.75 mg a.s.	0.175 mg a.s.
Dermal absorption of a.s.	2%		
Weight of a.s. entering the body		0.0350 mg a.s.	0.0035 mg a.s.
Amount of a.s. left on the brush after 1 st wash and squeezing	35 mg – 17.5 mg = 17.5 mg		
Residues of a.s. on brush after 2nd washing		10% of 17.5 mg = 1.75 mg	
Amount of a.s. removed from the brush into the cleaning fluid = 17.5 mg – 1.75 mg = 15.75 mg			
Weight of a.s. squeezed out from brush onto cloth	50% of 1.75 mg = 0.875 mg		
Cloth absorbs 90% of a.s. squeezed out of brush therefore, weight of a.s. available to contaminate the hand	10% of 0.875 mg = 0.0875 mg		
Penetration of a.s. through gloves	10%		
Weight of a.s. on hand		0.0875 mg a.s.	0.0088 mg a.s.
Dermal absorption of a.s.	2%		
Weight of a.s. entering the body		0.00175 mg a.s.	0.000175 mg a.s.
Amount of a.s. left on the brush after 2 nd wash and squeezing	1.75 mg – 0.875 mg = 0.875 mg		
Residues of a.s. on brush after 3rd washing		10% of 0.875 mg = 0.0875 mg	
Amount of a.s. removed from the brush into the cleaning fluid = 0.875 mg – 0.0875 mg = 0.7875 mg			
Weight of a.s. squeezed out from a brush onto a cloth	50% of 0.0875 mg = 0.04375 mg		
Cloth absorbs 90% of a.s. squeezed out of brush therefore, weight of a.s. available to contaminate the hand	10% of 0.04375 mg = 0.004375 mg		
Penetration of a.s. through gloves	10%		
Weight of a.s. on hand		0.004375 mg a.s.	0.0004375 mg a.s.
Dermal absorption of a.s.	2%		
Weight of a.s. entering the body		0.0000875 mg a.s.	0.00000875 mg a.s.
Total weight of a.s. entering the body (to 4 decimal places)		0.0368 mg a.s.	0.0037 mg a.s.
TOAL SYSTEMIC DOSE OF ACTIVE SUBATENCE FOR 60 KG ADULT (to 4 decimal places)		0.0006 mg a.s./kg bw	0.0001 mg a.s./kg bw

General Exposure Calculator For Washing Out Of Brushes

A computerised calculator to estimate the systemic dose from washing out of brushes is attached below.

Insert in the boxes marked '??' the figures relevant to your particular assessment and then click the cursor outside of the of the calculator format page; the subsequent values will compute until at the end of the computing exercise you should have the potential worse-case exposure for an adult washing out a brush which has been used for painting. This calculator format page can then be copied and pasted into the Dossier, possibly as an Appendix.



Calculator For
Systemic Exposure