

Recommendation no. 5
of the BPC Ad hoc Working Group on Human Exposure

**Non-professional use of antifouling paints:
exposure assessment for a toddler**

(Agreed at the Human Health Working Group I on 28 January 2015)

1. Background

At the WG-II-2014, a discussion took place on the need to further assess exposure of a toddler to antifouling paints via the dermal route and the oral route (hand-to-mouth transfer) by touching wet and dried paint on the surface of a boat. This scenario only applies to non-professional use of antifouling paints, as toddlers and other unprotected persons are prevented from entry to professional boatyards.

The need to further assess this scenario is determined by the fact that some antifouling substances have a highly toxic profile and toddlers may be accidentally exposed to the paint, for instance, if climbing a boat lying in the garden or on the beach. Toddler may be exposed when the paint is wet or after the paint has dried, since dried antifouling paints are designed to slowly release the active substance.

2. Aim of the recommendation

The aim of this recommendation is to assess the systemic exposure of a toddler touching antifouling paints on a treated surface in the following situations:

- Dermal exposure to wet paint
- Oral exposure to wet paint through hand-to-mouth transfer
- Dermal exposure to dried paint
- Oral exposure to dried paint through hand-to-mouth transfer

The scenarios considered in this document refer to antifouling containing paints, but may also be relevant for uses of other types of paint. For antifouling paints, all of the four exposure scenarios (dermal and oral) for wet and dried paint apply. A tiered approach is presented.

3. Discussion and proposal for harmonisation

The parameters for the calculation of the exposure of a toddler to antifouling paints via the dermal route and the oral route (hand-to-mouth transfer) by touching wet and dried paint on the surface of a boat are indicated in the sections below.

Default values to be used in the calculations:

Parameter	Value	
	Wet paint	Dried paint
Transfer coefficient of paint from treated surface to hand	50% ¹	3% ²
Area of toddler hands – <u>palms only of both hands</u>	115.2 cm ^{2 3}	115.2 cm ^{2 3}
Proportion of palms of hand in contact with the paint	100% ⁴	40% ⁵
Transferable fraction of paint from hand to mouth (for wet paint) / Transfer coefficient of paint from hand to mouth (for dried paint)	10% ⁶	50% ⁷
Toddler body weight	10 kg ⁸	10 kg ⁸

¹ The transfer of the paint from the treated surface to the toddler hands is unlikely to be 100 % as the paint is a sticky substance; the paint would probably stick equally as well to the treated surface as to the skin of the hands. Therefore, it is reasonable to assume that 50 % of the touched paint will transfer to the hand and 50 % will remain sticking to the treated surface.

² TNsG (2002), Part 2, page 204 transfer coefficient – dislodgeable residues, substrate: painted wood (MDF), residue of dried fluid on the dried surface of painted wood.

^{3,8} HEEG opinion 17 - Default human factor values for use in exposure assessments for biocidal products

⁴ The hands might be pressed into the paint and smeared around.

⁵ Brouwer *et al* (1999) found that following single-hand press contacts onto a powder-loaded glass plate; about 40 % of the palm of the hand was exposed following 12 contacts.

⁶ **For wet paint:** A toddler is unlikely to lick all of the wet paint from its two hands but is more likely that two fingers from one hand could be sucked. Two fingers from one hand constitutes about 10 % of the total palm area of both hands (i.e. default of 115.2 cm² for surface area of both palms x 10% = 11.52 cm²). In the absence of data to the contrary, it is assumed all wet paint entering the mouth is ingested to become a systemic dose.

⁷ **For dried paint:** A transfer coefficient of 50 % is the default assumption from the Pest Control Fact Sheet (2006; section 2.2.7 "Parameters for hand-mouth contact"). The dried paint does not result in a visible layer on the skin and may go unnoticed by the toddler's parents, and by the toddler itself, when the toddler is mouthing its hands/fingers. Thus, rather than merely sucking two fingers from one hand (as in the wet paint scenario), the toddler could lick/suck the whole of its two hands, but only 40% of the surface area of the palms of both hands is contaminated. In the absence of data to the contrary, it is assumed all dried paint entering the mouth is ingested to become a systemic dose.

The Applicant supplies the following data: application rate for antifouling paint application, density of the paint, concentration of active substance (a.s.) in paint, dermal and oral absorption and leaching rate (if needed).

3.1 Exposure to wet paint

3.1.1 Tier 1

The parameters for the Tier 1 assessment of dermal exposure and oral exposure through hand-to-mouth transfer of a toddler touching wet antifouling paint on a treated surface are as follows:

Tier 1: Dermal exposure to wet paint	
Parameter	Value
Amount of a.s. per unit treated surface area for wet paint	
Application rate for antifouling paint (non-professional) application	ml paint/cm ²
Density of wet paint	g/ml
Application rate for wet paint	mg paint/cm ²
Concentration of a.s. in wet paint	% w/w
Amount of a.s. per unit treated surface area for wet paint	mg a.s./cm ²
Amount of a.s. on palms of both hands from contact with removed wet paint	
Transfer coefficient of wet paint from treated surface to hand	50%
Amount of a.s. per unit treated surface area for wet paint – that is transferable from treated surface to the hand	mg a.s./cm ²
Total area of toddler hands in contact with the removed wet paint – <u>palms of both hands</u>	115.2 cm ²
Amount of a.s. on palms of both hands from contact with removed wet paint	mg a.s.
Systemic DERMAL exposure to wet paint	
Dermal absorption	%
Amount of a.s. absorbed through the skin	mg a.s.
Toddler body weight	10 kg
Systemic DERMAL exposure to wet paint	mg a.s./kg bw/event

Tier 1: Oral exposure to wet paint from hand-to-mouth transfer	
Parameter	Value
Amount of a.s. per unit treated surface area for wet paint	
Application rate for antifouling paint (non-professional) application	ml paint/cm ²
Density of wet paint	g/ml
Application rate for wet paint	mg paint/cm ²
Concentration of a.s. in wet paint	% w/w
Amount of a.s. per unit treated surface area for wet paint	mg a.s./cm ²
Amount of a.s. on palms of both hands from contact with removed wet paint	
Transfer coefficient of wet paint from treated surface to hand	50%
Amount of a.s. per unit treated surface area for wet paint – that is transferable from treated surface to the hand	mg a.s./cm ²
Total area of toddler hands in contact with the removed wet paint – <u>palms of both hands</u>	115.2 cm ²
Amount of a.s. on palms of both hands from contact with removed wet paint	mg a.s.
Systemic ORAL exposure to wet paint	
Transferable fraction of wet paint from hand to mouth (i.e. from two fingers only)	10%
Amount of a.s. transferrable to the mouth	mg a.s.
Oral absorption	%
Amount of a.s. ingested	mg a.s.
Toddler body weight	10 kg
Systemic ORAL exposure to wet paint	mg a.s./kg bw/event

Systemic dermal and oral exposures to wet paint need to be added together to give the combined systemic exposure to the wet paint. If refinement is needed, it can be noted that this calculation takes part of the material into account twice (both dermal and oral uptake). Consequently, the calculations may be performed again taking this into consideration.

3.2 Exposure to dried paint

3.2.1 Tier 1

The parameters for the Tier 1 assessment of dermal exposure and oral exposure through hand-to-mouth transfer of a toddler touching dried antifouling paint on a treated surface are as follows:

Tier 1: Dermal exposure to dried paint	
Parameter	Value
Amount of a.s. per unit treated surface area for dried paint	
Application rate for wet antifouling paint (non-professional) application	ml paint/cm ²
Density of wet paint	g/ml
Application rate for wet paint	mg paint/cm ²
Concentration of a.s. in dried paint ¹	% w/w
Amount of a.s. per unit treated surface area for dried paint	mg a.s./cm ²
Amount of a.s. on palms of both hands from contact with removed dried paint	
Transfer coefficient of dried paint from treated surface to hand	3%
Amount of a.s. per unit treated surface area for dried paint – that is transferable from treated surface to the hand	mg a.s./cm ²
Total area of toddler hands in contact with the removed dried paint – <u>palms of both hands</u>	46.08 cm ² ²
Amount of a.s. on palms of both hands from contact with removed dried paint	mg a.s.
Systemic DERMAL exposure to dried paint	
Dermal absorption	%
Amount of a.s. absorbed through the skin	mg a.s.
Toddler body weight	10 kg
Systemic DERMAL exposure to dried paint	mg a.s./kg bw/event

¹ As the paint dries, solvents will evaporated from the wet paint resulting in higher concentration of active substance in the dried paint, compared to the wet paint. The concentration of active substance in the dried paint needs to be supplied by the Applicant or derived from the formulation details for the wet paint.

² 40% of the maximum palm area of both hands in contact with dried paint; total maximum palm area of both hands = 115.2 cm².

Tier 1: Oral exposure to dried paint from hand-to-mouth transfer	
Parameter	Value
Amount of a.s. per unit treated surface area for dried paint	
Application rate for wet antifouling paint (non-professional) application	ml paint/cm ²
Density of wet paint	g/ml
Application rate for wet paint	mg paint/cm ²
Concentration of a.s. in dried paint ¹	% w/w
Amount of a.s. per unit treated surface area for dried paint	mg a.s./cm ²
Amount of a.s. on palms of both hands from contact with removed dried paint	
Transfer coefficient of dried paint from treated surface to hand	3%
Amount of a.s. per unit treated surface area for dried paint – that is transferable from boat to the hand	mg a.s./cm ²
Total area of toddler hands in contact with the removed dried paint – <u>palms of both hands</u>	46.08 cm ² ²
Amount of a.s. on palms of both hands from contact with removed dried paint	mg a.s.
Systemic ORAL exposure to dried paint	
Transfer coefficient of dried paint from hands to mouth	50%
Amount of a.s. transferrable to the mouth	mg a.s.
Oral absorption	%
Amount of a.s. ingested	mg a.s.
Toddler body weight	10 kg
Systemic ORAL exposure to dried paint	mg a.s./kg bw/event

¹ As the paint dries, solvents will evaporated from the wet paint resulting in higher concentration of active substance in the dried paint, compared to the wet paint. The concentration of active substance in the dried paint needs to be supplied by the Applicant or derived from the formulation details for the wet paint.

² 40% of the maximum palm area of both hands in contact with dried paint; total maximum palm area of both hands = 115.2 cm².

Systemic dermal and oral exposures to dried paint need to be added together to give the combined exposure to the dried paint. If refinement is needed, it can be noted that this calculation takes part of the material into account twice (both dermal and oral uptake). Consequently, the calculations may be performed again taking this into consideration.

3.2.2 Tier 2

It is possible to refine the Tier 1 assessment of dermal exposure and oral exposure through hand-to-mouth transfer of a toddler touching dried antifouling paint on a treated surface by using leaching data. This Tier 2 approach applies to dried antifouling paints, and not to wet antifouling paints.

In the above Tier 1 dermal and oral exposure scenarios for dried paint, it is assumed that the transfer coefficient for a.s. from the treated surface to the skin is 3%, based on the TNsG data. This value is for transfer to skin of dried fluid from an already dried painted surface on wood, i.e. the biocide residue film is just laying on the surface of the dried paint on the wood. However, with antifoulings, the a.s. is embedded in the matrix of the paint and therefore will not be immediately available for dislodgement. The leaching data for dried antifouling paint will possibly give a more realistic, yet still conservative, assessment for the amount of active substance which will be dislodgeable.

Tier 2: Dermal exposure to dried paint	
Parameter	Value
Leaching rate	µg a.s./cm ² /day
Total area of toddler hands in contact with the removed paint – <u>palms of both hands</u>	46.08 cm ² ¹
Daily leached mass - i.e. amount of a.s. on 40% of palms of both hands	µg a.s.
Dermal absorption	%
Amount of a.s. absorbed through the skin	mg a.s.
Toddler body weight	10 kg
Systemic DERMAL exposure to dried paint	mg a.s./kg bw/event

¹ 40% of the maximum palm area of both hands in contact with dried paint; total maximum palm area of both hands = 115.2 cm².

Tier 2: Oral exposure to dried paint from hand-to-mouth transfer	
Parameter	Value
Leaching rate	µg a.s./cm ² /day
Total area of toddler hands in contact with the removed paint – <u>palms of both hands</u>	46.08 cm ² ¹
Daily leached mass - i.e. amount of a.s. on 40% of palms of both hands	µg a.s.
Transfer coefficient of dried paint from hands to mouth	50%
Amounts of a.s. on palms of both hands	mg a.s.
Oral absorption	%
Amount of a.s. ingested	mg a.s.
Toddler body weight	10 kg
Systemic ORAL exposure to dried paint	mg a.s./kg bw/event

¹ 40% of the maximum palm area of both hands in contact with dried paint; maximum palm area of both hands = 115.2 cm².

Using this Tier 2 assessment, systemic dermal and oral exposures to the dried paint need to be added together to give the combined exposure to the dried paint.

It is unlikely that the toddler will be exposed to both wet paint and dried paint during the same day. This is because: should the toddler be exposed to wet paint then, the toddler will become under greater supervision and kept away from the treated surface; and wet antifouling paint take some considerable time to dry.

4. References

- [HEEG opinion 17 - Default human factor values for use in exposure assessments for biocidal products](#)
- [Technical Notes for Guidance \(TNsG\), 2002](#), Human Exposure to Biocidal Products, Part 2
- Brouwer D.H., Kroese R., Van Hemmen J.J., Applied Occupational and Environmental Hygiene, Vol 14: 231-239 (1999)
- Pest Control Products Fact Sheet, [RIVM report 320005002/2006](#)