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HEEG OPINION

For exposure assessment for professional operators undertaking industrial treatment of wood by fully automated dipping

This document was prepared by UK in cooperation with HEEG.

1. INTRODUCTION

Difficulties have been met in assessing exposure for fully automated dipping. This is because there are no quantitative data (i.e. indicative exposure values) in the TNSGs specific to this application process. Of the available data, the closest possible equivalent exposure model is that for 'intermittently handling water-wet/solvent-damp wood' (Handling Model 1 in User Guidance version 1, 2002).

This Opinion Paper puts forward a way to resolve this difficulty by considering what is actually happening during vacuum/pressure impregnation of timber (for which exposure data is available) and comparing what is actually happening in fully automated dipping. This allows identification of similarities in operator exposure between the two treatment processes and harnesses the existing quantitative exposure data which are published in the TNSGs for vacuum/pressure impregnation.

The following is for exposure assessment for professional operators undertaking industrial treatment of wooden articles by **fully automated dipping**. This paper also gives three additional exposure scenarios which are associated with fully automated dipping (i.e., mixing/loading of dip tank – if applicable; re-stacking of fallen timber at wood drying/storage site; and cleaning out of dip tank).

2. DISCUSSION OF DERMAL EXPOSURE ASSOCIATED WITH VACCUUM/PRESSURE IMPREGNATION OF WOODEN ARTICLES BY PROFESSIONAL OPERATORS

(a) In **vacuum/pressure treatment**, major dermal contamination of operators from contaminated equipment surfaces and from contact with the wet treated wooden articles would be only for a short period during any cycle; i.e.:

- At start of the cycle when boggies are loaded with untreated timber and are pushed on rails into the treatment chamber. Some dermal contamination would be from touching the contaminated boggies; the boggies are not cleaned between cycles and thus, the boggies themselves will be contaminated with wood preservative used in the previous cycle.
- The door of the chamber is closed, wood preservative is pumped into the sealed chamber and the vacuum/pressure applied. After the predetermined treatment time, pressure in the chamber is released, and the timber is allowed to drain for a while before the chamber doors are opened. In this phase the operator will not be freshly dermally contaminated with wood preservative other than by intermittent contact with contaminated equipment.
- At the end of the cycle when the boggies – now loaded with the wet treated wood – are pulled out of the chamber. Some dermal contamination would be from touching the contaminated boggies and from unlocking of any retaining straps and touching the now wet treated wood during unloading; the wood is usually unloaded by forklift truck and then transported to a storage area to dry.

From the above, it can be seen that in effect operators undertaking vacuum/pressure impregnation are probably dermally exposed to wood preservative over a short period during the impregnation cycle; i.e. during the few minutes at the start and the few minutes at the end of the impregnation cycle.

3. DISCUSSION OF DERMAL EXPOSURE ASSOCIATED WITH FULLY AUTOMATED DIPPING UNDERTAKEN BY THE PROFESSIONAL OPERATORS

(a) In **fully automated dipping**, wooden articles are treated in a batch process or as a continuous process (conveyor belt/rack treatment).

- **In a batch process**, prior to dipping, the untreated wooden articles are bundled into piles held together by tension straps. Articles are usually separated by wood blocks (separators) to permit flow of preservative around the articles.

The untreated wood is placed by a forklift onto a hydraulic lifting/lowering devise which is an integral part of the dip tank. This hydraulic devise lowers – and as necessary holds – the timber below the fluid in the dip tank.

After a predetermined period in the dip tank, the wood is raised and excess preservative fluid is allowed to drain back into the dip tank. The wet/damp treated wood is then transferred using the forklift to a storage area to dry.

- **In the case of highly automated continuous treatment facilities**, the transport of untreated timber pile to the dip tank is by conveyors; the pre-bundled piles of wood articles being first loaded onto the conveyor by fork-lift truck/specialist wood loader equipment from the storage yard. Following drainage, the conveyor automatically moves the now treated timber pile to a drip collection area. Following this dripping and initial drying stage, a forklift truck is used to transport the timber to a storage area.
- In these batch and highly automated processes, until the wood is dry, the tension straps and separators are not removed. Sometimes the treated timber remains in this state until after it has been transported dry and arriving at the wood merchant.
- **Where joinery articles (e.g. window frames) are to be dipped**, the individual untreated articles are manually hung on a conveyor or loaded into a rack. The articles are then automatically transported through the dip tank and then through a dust free drying area. (Wet items are not touched manually to avoid any finger/hand marks spoiling the top coating). After drying the treated items are removed from the conveyor/rack for further processing or storage.
- *(The European Wood Preservative Manufacturers Group has informed that where the untreated timber still on the forklift truck is dipped, held under the fluid in the dip tank, raised to drip and then transferred on the forklift truck to the drying/storage area is **not fully** automated dipping).*

(b) Consequently, in fully automated dipping of timber, there appears to be very little opportunity for direct dermal contact between the treated wet timber and the operator undertaking the dipping; the only sources for dermal contamination being from:

- contact with contaminated equipment surfaces (equipment surfaces will not be as contaminated with wet fluid as is vacuum/pressure equipment (e.g. the bogies);
- should the tension straps fail and the pile of wooden articles falls apart – the restacking of the fallen treated wet timber onto the forklift or the hydraulic lift device which forms an integral part of the dip tank; and
- re-positioning the wooden article on the conveyor/in the rack when individual items fall off/the conveyor, or out of a rack.

(c) In light of this information, the following is considered to be a definition of **fully automated dipping** appropriate for product labels where only fully automated dipping is to be recommended:

‘Product X must only be used in fully automated dipping processes where all steps in the treatment and drying process are mechanised and no manual handling takes place, including when the treated articles are transported through the dip tank to draining/drying and storage (if not already surface dry before moving to storage). Where

appropriate, the wooden articles to be treated must be fully secured (e.g. via tension belts or clamping devices) prior to treatment and during the dipping process, and must not be manually handled until after the treated articles are surface dry.’

4. DISCUSSION OF MODELS AVAILABLE TO ASSESS OPERATOR EXPOSURE FOR FULLY AUTOMATED DIPPING

(a) Comparisons of Patterns of Dermal Exposure: The patterns of dermal exposure for professional operator exposure undertaking industrial/professional pre-treatment of timber by vacuum/pressure impregnation and by fully automated dipping [see descriptions of both processes in Sections 3 and 4 above] are comparable in that, operators are dermally exposed through contact with contaminated equipment surfaces and through handling wet treated wood. In the case of fully automated dipping, the operator should only need to handle the wet treated wood should the tension straps fail and the wooden articles have to be restacked (in the batch process) or the articles be re-positioned in the conveyor/rack processes; these would be a worse-case scenarios.

(b) Comparisons of Duration of Dermal Exposure:

(i) During vacuum/pressure impregnation, though exposure from contaminated equipment surfaces is possible throughout the treatment cycle, it is only at the beginning and at the end of the cycle that major dermal exposure will occur. For fully automated dipping, there will be a similar pattern of dermal exposure: exposure from contaminated equipment surfaces and major operator contamination, but **only** at the end of the dipping cycle and **only if** tension straps fail requiring the wooden articles need to be re-stacked or if the wet treated wood requires re-positioning on conveyors/in the racks. The actual duration of the operator dermal exposure in fully automated dipping, particularly manual handling of wet treated wood, can also be considered to comparable to that occurring in vacuum/pressure impregnation but, for fully automated dipping this would only occur when the elements in the dipping process fail and so can be considered a **worse case**.

(ii) In the HEEG Opinion on ‘Defaults and appropriate models to assess human exposure for dipping processes (PT 8)’ [MOTA version 4, section 4.2.9.8] it was agreed that the default frequency for the automated dipping should be 4 dipping cycles per day.

(iii) In fully automated dipping the wet treated timber is not manually handled - or rarely. As a relative worse case for fully automated dipping it is assumed that **once per day**, the wet treated has to be manually handled/re-stacked/re-positioned. [In an Applicant-submitted a survey of 24 companies asked whether stacking of freshly treated timber took place, stacking of freshly treated timber did not take place or took place only infrequently. One company informed freshly treated timber needed to be stacked only 1 time in every 20 cycles; all other 23 companies informed that the freshly treated wood did not need re-stacking]. Thus as a **worse case**, it is assumed that for fully automated dipping, wet treated timber would need to be manually handled **during one in four of the daily dipping cycles**.

(c) Indicative Exposure Values for Fully Automated Dipping:

(i) The most appropriate model available is Handling Model 1, which is for the professional intermittently handling of water-wet or solvent-damp wood and associated equipment [TNsG, Part 2 (June 2002), page 160 – updated by User Guidance version 1 (2002), page 26]. These data re from exposure surveys of professional operator applying wood preservative fluids by vacuum/pressure impregnation in an industrial setting. The Handling Model 1 data give indicative exposure values **in mg in-use product/cycle** for hand, body and inhalation for both water-based and solvent-based in-use products.

(ii) As the pattern of exposure and the duration of potential worse-case exposure for fully automated dipping, are comparable to this for vacuum/pressure impregnation, it is considered that – as worse case - the same indicative exposure values for vacuum/pressure impregnation expressed in mg in-use product/cycle (Handling Model 1) can be used to assess professional exposure during fully automated dipping; these indicative dermal exposure values are:

Dermal - for water-based in-use products:

Hands (inside gloves): 1080 mg in-use product/cycle

Body: 8570 mg in-use product/cycle

Dermal - for solvent-based in-use products:

Hands (inside gloves): 260 mg in-use product/cycle

Body: 158 mg in-use product/cycle

(iii) TNsG/User Guidance data for vacuum/pressure impregnation also informs of **inhalation** exposure for the vacuum/pressure impregnation of timber. Indicative exposure values are: 1.9 mg in-use product/m³ (for water-based in-use products); and 0.6 mg in-use product/m³ (for solvent-based in-use products). It is understood in the vacuum/pressure process, aerosol is released from the wood-charged chamber when the pressures inside the chamber are released into the environment and when the chamber doors are opened. Little generation of an aerosol is anticipated for fully automated dipping thus, it is proposed operator exposure via inhalation does not need to be taken into account.

(d) IN SUMMARY: As a worse-case (Tier 1) assessment (screening tool), the indicative dermal exposure values (in mg in-use product/cycle) for Handling Model 1 can be used to assess professional operator exposure during industrial treatment of wood by fully automated dipping; the re-stacking of wet, freshly treated wood being manually handled during one in four of the daily dipping cycles. This applies on condition that:

- The dipping process is fully automated (i.e., is intrinsically as described in paragraph **3a** above) and the product label, and/or associated literature, carries the

description (or similar) in **3c** above which restricts the product's use to fully automated dipping.

Nota Bene: This proposal does not include to exposure assessment for other forms of mechanical dipping; such as where the untreated timber still on the forklift truck is dipped, held under the fluid in the dip tank, raised to drip and then transferred on the forklift truck to the drying/storage area.

5. OTHER OPERATIONS ASSOCIATED WITH FULLY AUTOMATED DIPPING

The following three operations are identified:

(a) Mixing/loading the wood preservative in the dip tank

Where the wood preservative fluid is delivered by tanker and is transferred from the tanker into the dip tank using connecting hosing then, it could be assumed, providing the operator wears suitable PPE, exposure of the operator's skin is minimal and does not need to be quantified.

Where the wood preservative fluid is delivered in and is decanted from containers that are to be manually handled then a quantitative exposure assessment for this mixing/loading operation needs to be undertaken using an appropriate model (see the Manual of Technical Agreements: HEEG Opinion on the use of available data and models for the assessment of the exposure of operators during the loading of products into vessels or systems in industrial scale - Agreed at TM I08).

Cleaning of the dip tank takes place infrequently. Therefore, it is assumed complete filling of the dip tank takes place infrequently. However due to losses of wood preservative from the dip tank, from absorption the dipping fluid by wooden articles and general splashes, from time to time the dip tank will need topping up with more dip fluid.

(b) At wood drying/storage site - the transfer of timber from forklift truck and re-stacking of fallen wood

(i) At the drying/storage site, transfer of wet wood from the forklift truck might be undertaken manually or more likely, the forklift truck might drop the wet treated wood at the drying point.

At some point in the drying cycle piles of wooden articles in the storage area could fall, particularly if the tension straps fail, and the wooden articles will need to be manually re-stacked. It could be anticipated that this would not be a frequent occurrence; otherwise the wood yard would have devised a better means of drying/storing wooden articles. Therefore, it is assumed that in any day only one batch of timber from the dipping process will need to be manually re-stacked.

In any particular day, these operations will normally be undertaken by a person other than the person who is undertaking the actual dipping of the wood.

(ii) As the exposure of the person actually carrying out the dipping has already been assessed and this exposure being chiefly from handling the wet treated wood (when fallen wooden articles need

re-stacking/re-positioning) then, this same calculated exposure value can be used to define the exposure of the person re-stacking/re-positioning treated wood in the drying/storage area. It should be noted that, this exposure for is for a person re-stacking **wet** wood and in the drying/storage area, in many instances the wood will be dry thus, dermal exposure could be much less. Taking this into account might allow the exposure assessment to be refined if necessary.

(c) Cleaning of the dip tank

Available information indicates dip tanks are cleaned infrequently. Information provided by an Applicant from a survey of 24 companies informed of the number of times dip tanks were cleaned. [The answers ranged from: 'less than 1 time per year'; 'yearly' (11 companies); '2 times per year' (1 company); 'every 3rd year' (3 companies); 'every 5th year' (3 companies); 'every 5th - 6th year'(1 company); 'every 8th year' (1 company) to 'every 10th year' (4 companies). IN 19 companies, the dip tanks were cleaned by 'own staff'; in the remaining 5 companies employed another company to clean the tanks.

Further data/information are to be obtained to help define an exposure model for the cleaning of the dip tank.