# Cover note to:

# Leaching from paints, plasters, and fillers applied in urban areas


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***Version information:***

Version 6, 12 November 2015.

## *Note to the reader*

The underlying document concerns the final version of our proposal to calculate the emission from preservatives applied in paints and coatings (PT07), wood (PT08), polymerised materials (PT09), and masonry (PT10) applied in urban areas. The first version was introduced at TMII-2012, the second at TMIV-2012 where it was decides that:

- plasters are applied 4 kg/m²;
- the surface of silicone caulks in bathrooms are 0.12 m²;
- the market share is 100% unless sufficiently substantiated with tonnage data;
- no additional scenarios for suburban areas where rainwater is collected and discharged to surface water directly will be included in the current proposal

Moreover, the surface of sealants applied outdoors was lowered from 2 to 0.45 m² per house. This value was agreed during the discussion concerning tebuconazole at TMIV-2012.

Version 3 was discussed during TMII-2013 where it was decided to:

- add a remark concerning the service life of plasters which may vary among different types (DK);
- adjust the surface of silicone caulks around windows as the suggested value was based on vertical joints between houses (DK);
- add a reference to DE's proposal for direct emission to surface water via separated sewer systems (STP bypass);
- include a reference to DE's proposal for roof membranes;

Version 4 was discussed during TMIII-2013. Some small corrections were suggested. Version (5) is the final version for endorsement at TMIV-2013.

It appears that the number of houses presented in Table 1 were incorrect for some applications. These were corrected in version 6 (12 November 2015)


Thanks to those who submitted useful comments on our draft version. Their suggestions and improvements are incorporated in the underlying document.


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# Leaching from paints, plasters, and fillers applied in urban areas

## Introduction

The current emission scenarios for (in-can) preservation of paints and coatings, wood preservatives, preservatives for fibrous and polymerised materials, and masonry preservatives consider direct exposure from a single house to adjacent soil and surface water, while preserved materials are also applied in urban areas where waste water is collected and discharged to the sewer system. Although the ESD for PT10 offers a city scenario, the emission is however calculated from the treatment of one house only, which may result in an underestimation of the actual risks. In the current document a city scenario in which the emission to the sewer system of preservatives applied in an urban environment is presented. This scenario calculates the daily emission of preservatives that are spilled during application or lost by leaching during the preserved product's service life. Depending on the configuration of the sewer system the preservatives are discharged to the sewage treatment plant (STP), or directly to surface water and sediments in case when rain water is collected separately without being mixed with domestic, institutional, and industrial waste water. Final predicted environmental concentrations (PECs) are calculated with SimpleTreat and the Technical Guidance Document (TGD) when discharged to the STP. In case of emission to a separated sewer systems, the STP is bypassed, and effluent volumes and dilution factors must be adjusted accordingly. PECs are then estimated according to the proposal for the assessment of direct emission to surface water. Note that the city scenario only concerns downtown areas considered paved. Suburbs are not considered in this scenario as houses are usually surrounded by gardens and sewage systems meant for precipitation are not necessarily connected to an STP.

Product authorisation requires data on leaching over the initial assessment period (30 days) and the longer assessment period (service life) to assess environmental exposure of in-can preservatives (PT06) when applied to preserve paints, plasters, joints sealants, and other building materials during storage, film preservatives (PT07), wood preservatives (PT08), fibre, leather, rubber and polymerised materials preservatives (PT09), and masonry preservatives (PT10). Especially for PT06, leaching data for all different types of paints, coatings and plasters is not always available. Therefore two methodologies are proposed: one when leaching data is available and a worst case approach that considers 100% leaching during the preserved product's service life.

## The city scenario

### *Normal case approach: leaching data is available*

An average sewer system receives waste water from 4000 houses. However, these houses contribute differently to the environmental emission as some are recently painted or plastered and others were treated longer ago. For the recently painted houses leaching is expected to be rapid, while leaching from surfaces painted or plastered in the past is slow or even negligible. It is assumed that the ratio recently painted houses to houses painted more than 30 days ago will not change in time as it is unlikely that all houses are painted or plastered simultaneously. For example, the leaching rate of an active substance from a paint will change from fast to slow when a house was painted 30 days ago, but will be replaced by another house for which repainting was necessary as the paint reached the end of its service life.In an ideal situation leaching data from long-term (field) studies are available from which a leaching rate (for PT08) or cumulative leaching (input for PT10) for the initial (30 days) and the longer (service life) assessment period can be derived.

The proposed city scenario strongly depends on parameters for which little knowledge is available yet. For the city scenario the following defaults are advised :

- a service life of:
  - 5 years for paints (which is also proposed in the revised ESD for wood preservatives) and sealants around windows and doors outside;
  - 10 years for indoor fillers (sealants);
  - 25 years for outdoor joint fillers and outdoor façade plasters;
- products holding the specific preservative is applied on all houses in a city ($f_{house}$ = 1.0). These value may be reduced when sufficiently substantiated with tonnage data;
- the surface of:
  - a standard house is 125 m² (default for wood preservatives);
  - joint fillers applied between bricks per house of 125 m² is 35 m² (see appendix);
  - exterior windows frames and doors is 5.57 m² per house
  - sealants around windows and doors on a standard house is 0.31 m²;
  - joint fillers between tiles in the wet area of bathrooms is 0.24 m²;
  - sealants in bathrooms is 0.12 m².

Relevant values for roof membranes are found in the proposal for the emission from roof membranes which was discussed at TMII-2013. Considering this, the daily emission to an STP can be estimated by using the formulas and defaults as proposed below.

$$N_{houses,initial} = \frac{T_{initial}}{T_{servicelife}} \cdot N_{house} \cdot f_{house} \quad (1$$

$$N_{houses,longer} = \frac{T_{longer}}{T_{servicelife}} \cdot N_{house} \cdot f_{house} \quad (2$$

$$E_{local} = \frac{(N_{house,initial} \cdot Q_{leach,time1} \cdot AREA)}{T_{initial}} + \frac{(N_{house,longer} \cdot Q_{leach,time2} \cdot AREA)}{T_{longer}} \quad (3$$

where:

- $N_{house,initial}$ number of houses in a city recently treated (-);
- $N_{house,longer}$ number of houses in a city treated more than 30 days ago (-);
- $T_{initial}$ time for the initial assessment period (30 d);
- $T_{longer}$ time for the longer assessment period (d) (remaining service life, see Table 1);
- $T_{service\ life}$ service life (d) (see Table 1)
- $N_{house}$ number of houses in a city (4000);
- $f_{house}$ fraction of the houses on which paints, plasters, or fillers are applied (market share = 1.0);
- $E_{local}$ daily emission to the sewer (kg/d);
- $Q_{leach,time1}$ cumulative leaching over 30 days (kg/m²);
- $Q_{leach,time2}$ cumulative leaching over service life minus 30 days (kg/m²);
- AREA area of the treated surface per house (m², see Table 1).

When applying the previously proposed defaults and formulas the daily emission to the sewer can be calculated by using the ratio of houses recently treated (<30 days) or treated more than 30 days ago, based on the service life of the product. These ratios are summarised in Table 1.

**Table 1. Service life and number of houses that contributes to leaching for the situation when both initial and longer assessment period leaching data is available.**

| application | service life (d) ($T_{service\ life}$) | area (m²) (AREA) | time over which leaching is calculated (days) | | number of houses from which the actives are leaching (-) | |
|---|---|---|---|---|---|---|
| | | | initial ($T_{initial}$) | longer ($T_{longer}$) | initial ($N_{houses,\ initial}$) | longer ($N_{houses,\ longer}$) |
| **Indoor applications** | | | | | | |
| joint fillers (bathroom) | 3650 | 0.24 | 30 | 3620 | 33 | 3968 |
| sealants (bathroom) | 3650 | 0.12 | 30 | 3620 | 33 | 3968 |
| **Outdoor applications** | | | | | | |
| paints applied on façade | 1825 | 125 | 30 | 1795 | 66 | 3934 |
| paints applied on window and door frames, and doors | 1825 | 5.57[1] | 30 | 1795 | 66 | 3934 |
| plasters applied on façades outdoors | 9125 | 125 | 30 | 9095 | 13 | 3987 |
| joint sealants applied outdoors | 1825 | 0.31[2] | 30 | 1795 | 66 | 3934 |
| joint fillers applied outdoors | 9125 | 35 | 30 | 9095 | 13 | 3987 |
| roof membranes | See 'Use-based approaches for the estimations of environmental exposure in case of roof membranes' discussed during TMII-2013. | | | | | |

1 Surface taken from appendix 6 of the revised ESD for wood preservatives (window and door surfaces for a single-floor 125 m² house);

2 Surface based on window and door frame perimeters calculated from the dimensions for a single floor 125 m² house as specified in appendix 6 of the revised ESD for wood preservatives.

## *Worst-case approach: leaching data is lacking*

However, leaching data is not always available and, therefore, emissions have to be calculated using a worst-case scenario in which 100% leaching is assumed during the product's service life. The daily emission to the sewer is then calculated as follows:

$$N_{houses,leach} = N_{house} \cdot f_{house} \quad (4$$

$$Q_{leach} = AREA \cdot V_{form} \cdot F_{form} \cdot RHO_{form} \cdot 10^{-3} \quad (5$$

$$E_{local} = \frac{(N_{house,leach} \cdot Q_{leach})}{T_{servicelife}} \quad (6$$

where:

- $N_{house,leach}$ number of houses that are contributing by leaching (-);
- $T_{service\ life}$ service life (d, see Table 2);
- $N_{house}$ number of houses in a city (4000);
- $f_{house}$ fraction of the houses on which paints, plasters, or fillers are applied (1.0, unless sufficiently substantiated with tonnage data);

- $Q_{leach}$ cumulative leaching (100%) over the assessment period (kg/m²);
- AREA area of the treated surface per house (m², see Table 2);
- $V_{form}$ volume of the product applied (m³, see Table 2);
- $F_{form}$ fraction of the active substance in product (-);
- $RHO_{form}$ density of the product (kg/m³, see Table 2);
- $E_{local}$ daily emission to the sewer (kg/d).

Note that the initial and longer assessment period are not separately assessed, because it was assumed that leaching rates for both the initial and longer assessment period are the same. Although this may underestimate leaching from recently treated objects, the total emission is likely overestimated as actual leaching rate for the longer assessment period is expected to be slower. The proposed worst case assumption assumed that leaching rates do not change in time. Table 2 summarise the proposed defaults for service life, i.e. the time over which emission should be assessed.

**Table 2. Service life and amount of houses that contributes to leaching for the situation when no leaching data is available**

| application | service life (d) ($T_{service\ life}$) | area (m²) (AREA) | density (kg/m³) ($RHO_{form}$) | volume applied (L/m²) ($V_{form}$) |
|---|---|---|---|---|
| **Indoor applications** | | | | |
| joint fillers (bathroom) | 3650 | 0.24 | 1900 | 0.42 |
| sealants (bathroom) | 3650 | 0.12 | 1000[1] | 5.88 |
| **Outdoor applications** | | | | |
| paints applied on façade | 1825 | 125 | 1400 | 0.25[2,3] |
| paints applied on window and door frames | 1825 | 5.57 | 1400 | 0.25 |
| plasters applied on façades outdoors | 9125 | 125 | 1000[1] | 4.0 |
| joint sealants applied outdoors | 1825 | 0.31 | 1000[1] | 5.88 |
| joint fillers applied outdoors | 9125 | 35 | 1900 | 2.8 |
| Roof membranes | See 'Use-based approaches for the estimations of environmental exposure in case of roof membranes' discussed during TMII-2013. | | | |

1 The dose is already in kg/m². Therefore the density was set to 1000 kg/m³;
2 Two layers;
3 It was demonstrated that this value covers 85% of the paints.

## *Application phase*

Significant release to the STP may occur during the application of a product to which preservatives are added. The daily release during application is calculated as follows:

$$E_{local} = AREA_{house} \cdot V_{form} \cdot F_{form} \cdot RHO_{form} \cdot F_{brush} \cdot N_{house,applic} \cdot 10^3 \quad (7$$

where:
- $E_{local}$ daily emission to the sewer (kg/d);
- AREA area of the treated surface per house (m², see Table 2);
- $V_{form}$ volume of the product applied (m³, see Table 2);

- $F_{form}$ fraction of the active substance in product (-);
- $RHO_{form}$ density of the product (kg/m³, see Table 2);
- $F_{brush}$ fraction of product lost during application (0.03 for professionals and 0.05 for non-professionals);
- $N_{house,applic}$ number of houses treated per day (see below).

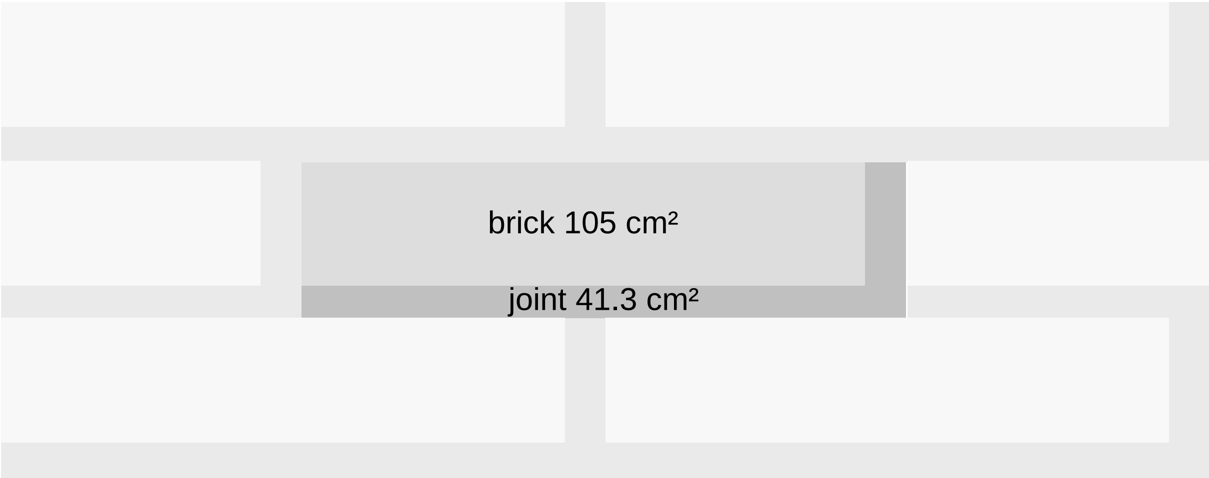
The number of houses treated daily depends on the service life of the product. For paints and joint sealants having a service life of 5 years 800 houses are treated annually when assuming that the product is applied on 100% of the houses in a city. Although this may suggest that 2.2 houses are painted daily, $N_{house,applic}$ have to be three houses per day to compensate for days that are not suitable for painting because of the temperature and/or precipitation. For all other products $N_{house, applic}$ is one.

## *References*


- Technical Guidance Document on Risk Assessment in support of Commission Directive 93/67/EEC on Risk Assessment for new notified substances; Commission Regulation (EC) No 1488/94 on Risk Assessment for existing substances; Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market. Part II. European Commission Joint Research Centre, EUR 20418 EN/2, Ispra, Italy, 2003.
- Struijs J. SimpleTreat 3.0: a model to predict the distribution and elimination of chemicals by sewage treatment plants. National Institute for Human Health and the Environment. RIVM report 719101025, Bilthoven, The Netherlands, 1996.
- Revised Emission Scenario Document for Wood Preservatives. Draft 2011. OECD Series on Emission Scenario Documents. Organisation for Economic Co-operation and Development, Paris.
- Proposal for the assessment of direct emission to surface water (PT 7, 9, 10). Proposal by DE discussed at TMII-2013.
- Use-based approaches for the estimation of environmental exposure in case of roof membranes (PT 9). Proposal by DE discussed at TMII-2013.

**Appendix: The surface of joints outdoors**

An average brick measures 21 × 5 cm and an average joint is 1.5 cm wide. To determine the total outdoor joint surface per house the joint fraction was calculated. Although each brick is surrounded by joints, the fraction was calculated by assuming only one horizontal joint and one vertical. This is explained in the figure below.




The surface of an average brick is:

$$21 * 5cm = 105cm^2$$

and that of a joint:

$$(5 \cdot 1.5cm) + (21 \cdot 1.5cm) + (1.5 \cdot 1.5cm) = 41.3cm^2$$

Therefore, the fraction of joints on a wall is:

$$\frac{41.3cm^2}{105cm^2 + 41.3cm^2} = 0.28$$

Each m² of wall contains 0.28 m² of joints and thus the total joint surface per house is:

$$125m^2 \cdot 0.28 = 35m^2$$

When assuming an average depth of 1 cm for a joint, the volume is:

$$0.28m^2 / m^2 \cdot 0.01m = 0.0028m^3 / m^2 = 2.8L / m^2$$