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TNO report

Modifications to the Stoffenmanager 4.0 inhalation model

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1 Introduction

Version 3.5 of Stoffenmanager was the first version of Stoffenmanager which enabled the estimation of inhalation exposure in mg/m^3 . The scientific basis for this was published in a peer reviewed paper, which describes the process of quantitatively calibrating the Stoffenmanager exposure algorithm (Tielemans et al., 2008). The next step was the validation of this new quantitative exposure model by using measured exposure data with contextual information.

This validation used a new dataset (dataset B, 254 measurements) selected from STEAMbase. These exposure measurements in dataset B were different from the exposure measurements in dataset A, which were used to calibrate the Stoffenmanager exposure algorithm (Tielemans et al., 2008). For each measurement in dataset B the exposure (in mg/m^3) was estimated based on the contextual information with the measurement by using Stoffenmanager. This Stoffenmanager exposure estimate was subsequently compared with the measured exposure (in mg/m^3) for each datapoint separately.

From the results of this validation it was concluded that Stoffenmanager generally estimates exposure well, but in two specific domains the exposure is not properly estimated:

1. Extremely low exposures (e.g. pharmacists while preparing medication in very low quantities) were overestimated by Stoffenmanager.
2. Extremely high exposures (e.g. transshipment of very high quantities (tons) of powders) were underestimated by Stoffenmanager.

2 Adaptation of the handling classification

The results from the validation were reason to add two extra categories to the Stoffenmanager classification for handling powders and/or granules: one extremely low handling category (score 0.03) and one extremely high category (score 30) to enable the estimation of inhalation exposure for these specific scenarios. For liquid scenarios an extra category was added to the lower end of the classification for handling liquids (score 0.03).

3 Separation of scenarios with low- and high-volatile liquids

Besides the addition of handling categories, the validation study elucidated that working with low-volatile liquids and working with high-volatile liquids could not be covered by one exposure model, because of the differences in exposure patterns:

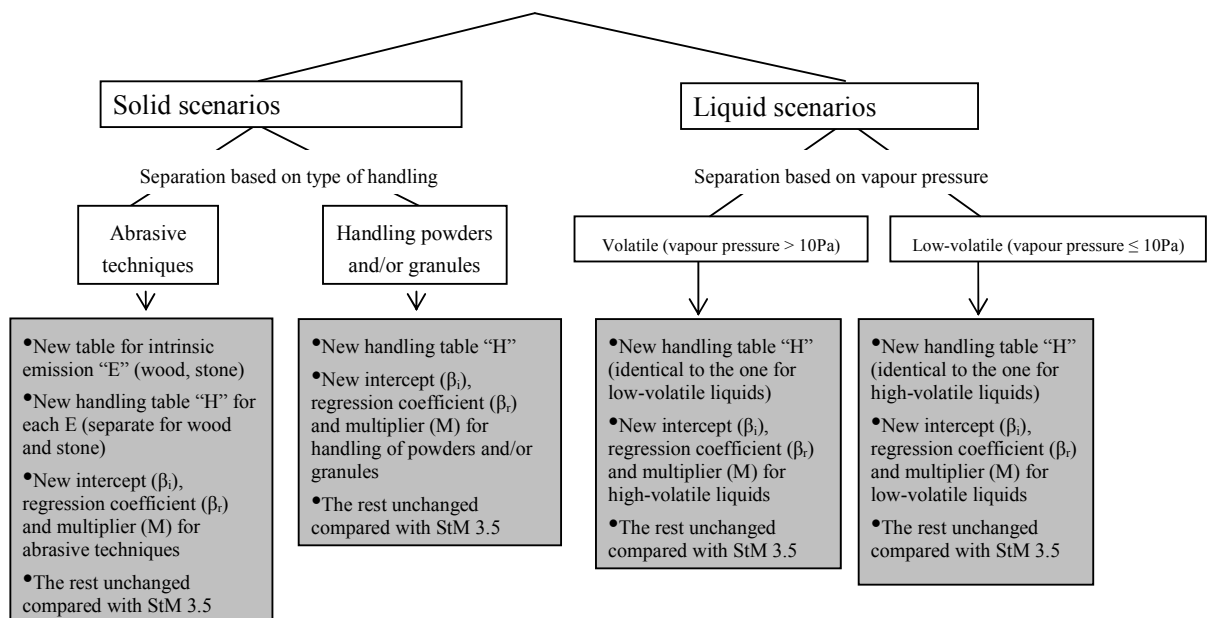
- High-volatile liquids: emission is mainly determined by evaporation
- Low-volatile liquids: emission is mainly determined by spraying or “splashing”.

4 Separation of solid scenarios in abrasive techniques with solid objects and handling of powders and/or granules

Similarly to the liquid scenarios, it was concluded from the validation study that handling powders and/or granules (e.g. dumping or weighing of powders) and abrasive techniques with solid objects (e.g. sanding or sawing) could not be covered by one exposure model, because of the different ways in which emission occurs.

5 Schematic overview of model adaptations

The figure below represents the adaptations in the Stoffenmanager 4.0 exposure models based on the separate four new exposure algorithms.



Subsequently, the datasets A and B were merged to form dataset C (total of 952 measurements). Dataset C was used to derive new exposure models separately for each of the above described four different models, using the same approach as previously described (Tielemans et al., 2008).

6 References

Tielemans E, Noy D, Schinkel J, Heussen H, van der Schaaf D, West J, Fransman W. (2008) Stoffenmanager exposure model: development of a quantitative algorithm. *Ann Occup Hyg*, 52(6): 443-454.