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GESTIS-Stoffenmanager®: quantitative non-measuring estimate of inhalation exposure

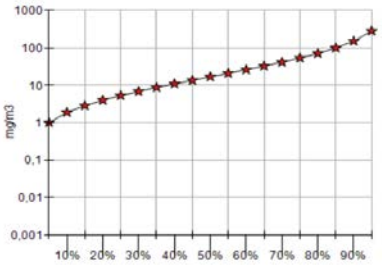
Problem

A risk assessment is required for activities with hazardous substances. To compare exposure with limit values and to decide on any necessary protective measures, Technical Rule on Hazardous Substances (TRGS) 402 states that inhalation exposure should be determined preferably by using non-measuring identification methods. Furthermore also the European REACH Regulation encourages the modelling of exposure heights to draw up exposure scenarios specific to the hazardous substance.

Activities

GESTIS-Stoffenmanager® makes it possible to quantitatively determine the hazardous substance concentration in the air at the workplace applying non-measuring methods. The algorithm employed for this purpose is based on an “emission source receptor” approach. The models for assessing exposure during activities with dusty products and liquids of high and low volatility and during abrasive work in stone- and woodworking are calibrated by correlation with over 700 exposure measurements. Results from various validation studies both from the Dutch TNO and with exposure data from the IFA MEGA exposure database have shown that the GESTIS-Stoffenmanager® yields a generally good exposure estimate and is sufficiently conservative. The Final Overall Project Summary Report of the "Evaluation of Tier 1 Exposure Assessment Models under REACH" (ETEAM) Study initiated by the BAuA says that GESTIS-Stoffenmanager® provides “the most balanced performance with regard to the level of conservatism and predictive power for volatile liquids and powders".

Isopropanol	mg/m³
50 Percentile	16,01
75 Percentile	51,08
90 Percentile	145
95 Percentile	271



Result of quantitative exposure estimates in GESTIS Stoffenmanager® including the concentrations in mg/m³, the risk characterisation ratio (RCR) as a relation to a limit value and the exposure distribution for one component.

Results and Application

For an estimation of the degree of exposure, information first has to be obtained on the used products and their ingredients (vapour pressure/dustiness, composition). Then details of the activity with the hazardous substance and of the workplace situation (room size, room ventilation, local exposure reduction measures) are gathered.

From the combination of these parameters, a hazardous-substance-specific concentration is estimated and expressed numerically in mg/m³ (see figure above).

If the result shows hazardous substance concentrations above the limit value (e.g. RCR > 1), GESTIS-Stoffenmanager® can be used for selecting exposure reduction measures on the hierarchical STOP principle (**S**ubstitution, **T**echnical measures, **O**rganisational Measures and **P**ersonal protective measures) and checking their effect on the concentration level. Due to the immediate estimation of the hazardous substance concentration expected under different conditions, the new concentration values can be directly compared to the previous ones (that exceeded the limit value). This way it is possible to check the exposure-reducing effect of further measures.

GESTIS-Stoffenmanager® also facilitates an estimation of a shift average exposure value for the exposure against dust or a hazardous liquid component. This is necessary particularly if a substance is contained in different products and is used during several activities during a working day. Essential for the calculation of the shift average exposure value are previous estimates of inhalation exposure for the various activities. After selecting the hazardous substance (inhalable dust or liquid component) concerned and stating the duration of the activity with this ingredient, the shift average value is calculated as a time-weighted mean exposure level over the 8-hour working day. To find out whether working conditions are safe, the calculated shift average value can be compared with the limit value.

The results of quantitative exposure estimates and shift average value calculations can also be saved as a text document or printed out for documentation purposes.

Area of Application

The “Quantitative exposure estimation” of GESTIS-Stoffenmanager® targets users, who wish to conduct a non-measuring exposure estimation and directly compare the result with limit values. Small and medium-size enterprises in particular are thus given the chance to estimate exposure as a guide before carrying out elaborate measurements.

Additional Information

- Tielemans, E. et al.: Stoffenmanager exposure model: development of a quantitative algorithm. Ann. Occup. Hyg. 52 (2008) pp. 443-454

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- Arnone M.; Koppisch, D.; Gabriel, S.: Der „GESTIS-Stoffenmanager® als Werkzeug zur quantitativen Abschätzung von Gefahrstoffkonzentrationen am Arbeitsplatz. Gefahrstoffe – Reinhalt. Luft 73 (2013) pp. 129-137

- Arnone M. et al.: Nichtmesstechnische Expositionsermittlung im Vergleich – Auswertung von Expositionsdaten aus MEGA und Expositionsabschätzung mit dem GESTIS-Stoffenmanager® – Praxisbeispiel Spritzlackieren. GRdL 75 (2015) pp 395-401.

Expert Assistance

IFA, Division 1: Information technology – Risk management

Literature Requests

IFA, Central Division

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