The MAK-Collection for Occupational Health and Safety

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Toluene

MAK Value Documentation, supplement – Translation of the German version from 2002

MAK Commission[1,*]

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Keywords:

toluene, peak limitation, excursion factor

MAK value (1993)	**50 ml/m³ (ppm) ≙ 190 mg/m³**
Peak limitation (2002)	**Category II, excursion factor 4**
Absorption through the skin (1998)	**H**
Sensitization	**–**
Carcinogenicity	**–**
Prenatal toxicity (1993)	**Pregnancy Risk Group C**
Germ cell mutagenicity	**–**
BAT value (1996)	**1.0 mg toluene/l blood** **3.0 mg *o*-cresol/l urine**
CAS number	108-88-3

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Peak Limitation Category

The re-evaluation of the toxic effects on behaviour of toluene led in 1993 to the lowering of the MAK value from 100 ml/m³ to 50 ml/m³. The re-evaluation was based on short-term and long-term observations in persons exposed to toluene which revealed effects on performance at about 75 ml/m³ and above (Echeverria et al. 1989 in Greim 1996; Foo et al. 1990 in Greim 1996) and on well-being at about 60 ml/m³ (lowest observed adverse effect level (LOAEL)) and above. In the meantime, new data are available for effects on performance and well-being from a 5-year follow-up study with 4 repeated investigations in persons exposed to toluene (Seeber et al. 1999, 2000, 2001; van Thriel 1999; van Thriel et al. 2000; Zupancic et al. 1999, 2002) and from studies of short-term effects of toluene (Gericke et al. 2001; Neubert et al. 2001 a, b; van Thriel 1999). In the first study, 80% of the 106 persons with "high-level exposure" were exposed on average for 13 years to concentrations of 25 to 74 ml/m³. The highest measured concentration was 170 ml/m³. Among the 1335 participants of the second study, 5% were exposed to toluene concentrations of between 50 and 100 ml/m³, 3% to over 100 ml/m³, and 1% to over 150 ml/m³. The peak concentration over one shift was 450 ml/m³ in one worker. In neither of the collectives could effects on performance

or well-being be reproduced. In the studies of Neubert et al. (2001 a, b), the workers were additionally divided into exposure groups. Fifty-six of the workers, who were classified as exposed to the highest concentrations, were exposed on average to 332 mg/m³ (about 87 ml/m³). No impairments were detected in the performance tests even in this group. It must however be noted that the tests took place during an exposure-free period or outside of the workplace.

Steady-state concentrations in blood are reached after about 25 minutes. The half-life for the second, slow elimination phase is given as 3.5 hours. Irritation of the mucous membranes is described as moderate to slight, that of the eyes as slight (Greim 1996).

As shown in the extensive new studies, toluene levels above the current MAK value do not lead to reproducible effects on performance and well-being. As it can be assumed that these collectives were exposed to even higher short-term peak concentrations, an excursion factor of 4 has been established. This is also in agreement with the peak limitation for the structurally related xylene. These studies, however, provide no reason to change the MAK value, as the majority of the persons investigated were exposed long-term in the concentration range below 50 ml/m³ and therefore no statement can be made regarding the effects on the heath of chronic exposure in the higher concentration range.

Notes

Competing interests

The established rules and measures of the Commission to avoid conflicts of interest (https://www.dfg.de/en/dfg_profile/statutory_bodies/senate/health_hazards/conflicts_interest/index.html) ensure that the content and conclusions of the publication are strictly science-based.

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