

ORGANIZATION AND EVALUATION OF PTS FOR THE DETERMINATION OF VOC-EMISSIONS FROM MATERIALS IN EMISSION TEST CHAMBERS

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INTRODUCTION

The document CEN TS 16516 of CEN/TC 351/WG 2 “Construction products – Assessment of emissions of regulated dangerous substances from construction products” is a standard for the determination of VOC (volatile organic compounds) emissions from construction products into indoor air. The determination is done by the use of emission test chambers in combination with appropriate sampling and analysis methods. A major problem for the execution of proficiency tests in this field is the lack of reference materials with known emission rates of target substances and appropriate concentrations in the test chambers in the range of 50 to 150 µg/m³.

METHODOLOGIES

From 2008 BAM conducted 4 proficiency tests using 4 different materials (sealing, lacquer, wooden board and lacquer, again). 29 participants took part in 2008 and until 2014 the number of participants increased to 55. Homogeneity of the test material was verified at BAM by doing up to 12 parallel chamber tests. Samples were shipped within a few days to the participants shortly before the common start (loading of test chambers). For the evaluation the mean (robust statistic) of all results was used as the assigned value. The evaluation was done by calculating z-scores using the commercial software PROLab. The requirement for a successful participation is a z-score between -2 and 2 for 80 % of the target compounds.

RESULTS AND DISCUSSION

In each proficiency test about 20 % of the participants could not fulfil the requirement for a successful participation. The standard deviations for the compounds in the 4 proficiency tests were between 14 and 53 %. According to Horwitz (2006) most of the results are in the range of his expected standard deviation of about 30 %. However, the standard deviation for each compound depends on its analytical behaviour and on its concentration in chamber air.

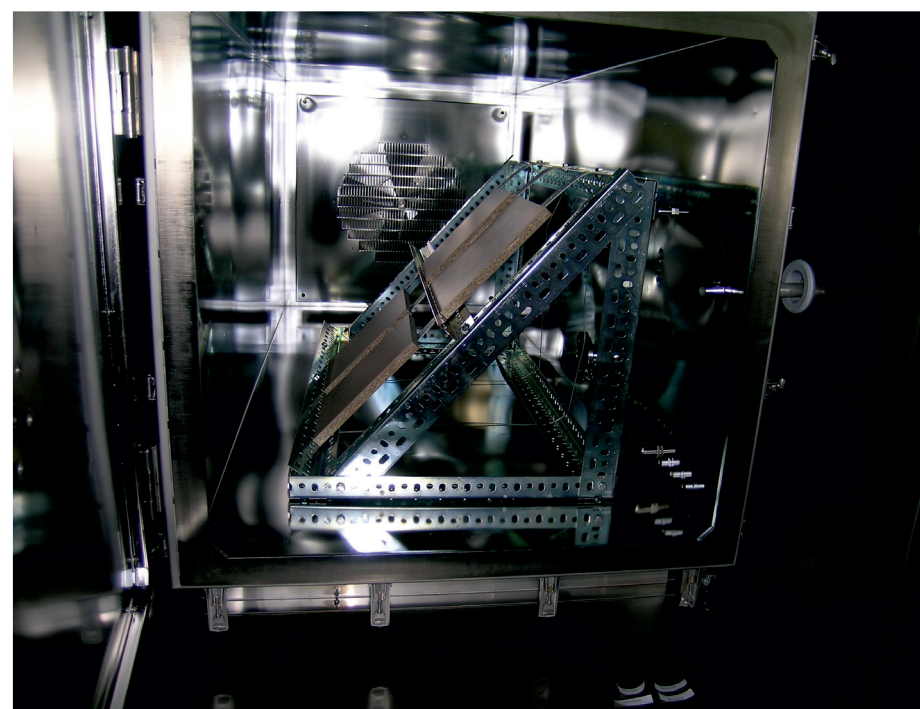
Results (1): Glycols and very polar compounds are problematic VOC with regards to the analysis. Also VOC with high boiling points showed higher standard deviations probably due to sink effects in the test chambers.

Results (2): Compounds with a standard deviation of more than 10 % from the BAM tests in 9 chambers showed also higher deviations in the overall results of all participants.

Standard deviations in % for compounds analysed in previous round robin tests

problematic VOC	2008	2010	2012	2014
Ethandiol	39			
DEGME		50		
Methoxy propyl acetate			42	
Hexanal		41	33	40
Acetic acid			53	
Methylpyrrolidone				47

“normal” VOC	2008	2010	2012	2014
Butanol	18			
Butyl acetate	20		32	
Dibutyl ether	14			
Butyl acrylate	19			
Styrene		28		31
Phenol		28		
Limonene		32		22
Tridecane		34		
Toluene			33	
Ethylbenzene			22	
m,p-Xylene			24	
o-Xylene			20	
Decane				25
Ethylhexanol				31
Ethyl hexyl acrylate				33



1 m³ test chamber with samples of the 2012 round robin test

Standard deviations in % for compounds analysed in previous round robin tests

VOC close to SVOC	2008	2010	2012	2014
Dimethyl phthalate				52
Hexadecane				43

Comparison of Standard deviations for BAM tests in 9 chambers and overall results for the 2014 round robin test

	Hexanal	Styrene	Decane	Ethylhexanol	Limonene	NMP	EHA	DMP	Hexadecane
Concentration in µg/m ³	17	55	48	30	48	26	38	54	40
BAM Standard Deviation in %	11	6	6	6	5	13	5	18	15
Participants Stand. Dev. in %	40	31	25	31	22	47	33	52	43