



FABES Forschungs-GmbH
für Analytik und Bewertung
von Stoffübergängen

Investigation Report

Emission study on asphalt with „Road+“

The results of the present investigation report are property of the contracting body. The use of the results by third parties, their publication or duplication, nor partially, is permitted only with a prior written approval of FABES Forschungs-GmbH.

The results of this emission study and their evaluation is related exclusively to the samples and parameters investigated.

contracting body : Degussa AG

assignment date : 09.10.2006

commission number : 1133/06

1. Aim

FABES Forschungs-GmbH and GfU Gesellschaft für Umweltchemie mbH have investigated in close collaboration the emission of organic compounds during production and paving of two asphalt types.

In advance the following agreements on the investigation procedure were made:

- Air samples should be taken at the production site, i.e. mixer (stationary) and the paving site (mobile).
- during production at both sampling points air samples of the Road+ asphalt and polymer modified asphalt, PmB (reference) should be taken.
- the following parameters should be sampled:
 - selected non- and medium polar volatile organic compounds (VOC) including mass spectrometric screening for unknown compounds,
 - selected semi-volatile organic compounds (SVOC) including mass spectrometric screening for unknown compounds,
 - polycyclic aromatic hydrocarbons (PAH),
 - and volatile N-nitrosamines.

For technical reasons the sampling for volatile N-nitrosamines was possible only stationary at the production site.

2. Air sampling and lead-through

Air samples were taken at two different sites (asphalt production and paving machine) close to the town 53343 Wachtberg.

Stationary air sampling took place at the asphalt production site (mixer) close to the village Villip. The air sampling device was located at the exit of the asphalt mixer close to the opening of one of the four asphalt storage container (approximate 0.5 m).

Mobile air sampling took place during asphalt paving on the road no. 158 between Meckenheim and Wachtberg / Villip at the drivers position on the paving machine.

2.1 Asphalt production and paving

The suitability test of the two asphalt types was performed by Gebr. von der Wettern GmbH, VdW. under test No. 4265 00 from 14.07.06. A PmB 45a asphalt of type stone mastix asphalt 0/8 S according to ZTV Asphalt-StB 01 with a target binder percentage of 7,0 m.-% was laid down. The Road+ asphalt laid down had a binder percentage of 7.8 m.-% from which 12.5%

were Road+ rubber mixture. The binder used for Road+ modification was of type 50/70. The stone types used for the asphalt production were limestone basalt sand and diabas split.

2.2 Air sampling

The air sampling was performed with pre-calibrated stationary and mobile devices (air sampling device).

A defined volume of air was sampled with the air sampling device during which the VOC's were adsorbed on an adsorption tube of type Anasorb 747. For determination of SVOC's and PAH's an adsorption tube of type Chromosorb 106 was used. For determination of volatile N-nitrosamines the sampling was performed with washing devices out of glass containing an aqueous 5 molar KOH adsorption solution. The sampled air volumes were recalculated for standard conditions (1013 hPa at 20°C).

2.3 Analytical procedure

- Non- to medium polar volatile organic compounds (VOC) according to VDI Bl.1+2 und VDI 4300 Bl.6 (corresponding to AA 10A010)
- Semi-volatile organic compounds (SVOC) according to: VDI 2100 Bl.1+2 (corresponding to AA 10A012)
- Polycyclic aromatic hydrocarbons (PAH) according to DIN ISO 12884 und BIA-Verfahren 6272 (corresponds to AA 10A007)
- Volatile N-nitrosamines (according to method BGI 505-23, former ZH 1/120-23)

3. Results

The results of the emission study can be summarised as follows:

Parameter	Road+		PMB	
	paving	mixer	paving	mixer
	[mg/m ³]	[mg/m ³]	[mg/m ³]	[mg/m ³]
SUM (VOC)	21,8	0,06	30,6	0,14
SUM (SVOC)	0,29	0,005	1,03	0,06
SUM (PAH)*	0,04	0,002	0,04	0,002
SUM (N-nitrosamines)	n.a.	n.d.	n.a.	n.d.

*) according to EPA (Environmental Protection Agency)

n.d. - not detectable, i.e. amount below detection limit (DL = 0,1 µg/m³)

n.a. - not assessed

Abbreviations:

VOC - volatile organic compounds

SVOC - semi-volatile organic compounds

PAH - polycyclic aromatic hydrocarbons

PmB - polymer modified bitumen

4. Evaluation

The emission of volatile and semi-volatile components is much lower during production of asphalt (mixing) compared to paving of asphalt.

The emission of VOC's, SVOC's, PAH's and volatile N-nitrosamines was investigated during production and paving of asphalt (Road+ and PmB).

During production of Road+ asphalt no emission of volatile N-nitrosamines was detected. No increase of PAH's emission during Road+ asphalt production and paving was detected. The detected PAH emission of Road+ asphalt is unchanged compared to PmB asphalt and is attributed to the bitumen used.

The emission of VOC's and SVOC's is lower for Road+ asphalt compared to PMB asphalt, despite the fact that approximate 10% more binder was used for Road+ asphalt production.

Based on this emission study for Road+ asphalt in comparison to PmB asphalt as reference the use of Road+ for asphalt production and paving is recommended without limitation.

This is an excerpt from the full investigation report with the same title dated from 29.12.2006

Munich, the 29th of December 2006

FABES Forschungs-GmbH

GfU Gesellschaft für Umweltchemie mbH



Dr. Rainer Brandsch

z. Z. verreist

Helmut Santl