


Bayerisches Landesamt für
Umwelt 

Heavy metals and organic contaminants in Bavarian composts – an overview

Heinz Riedel, Bavarian Environment Agency
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Heavy metals and organic contaminants
in Bavarian composts – an overview


Introduction

- Biowaste separation: Cornerstone of integrated waste management
- Since the 1990ies increasing coverage by bring / kerbside systems
- Core principle: Quality first!

Year	Collection	Biowaste, Bavaria
		Compost, composted fermentation residues
1993	1.01 · 10 ⁶ Mg/a	0.33 · 10 ⁶ Mg/a
1998	1.47 · 10 ⁶ Mg/a	0.52 · 10 ⁶ Mg/a
2003	1.72 · 10 ⁶ Mg/a	0.60 · 10 ⁶ Mg/a
2006	1.71 · 10 ⁶ Mg/a	0.58 · 10 ⁶ Mg/a

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Sampling


Carried out in September 2006

Compost plants included:

- 12 household biowaste compost plants (HBW-CP)
- 12 green waste compost plants (GW-CP)
- 5 plants for anaerobic digestion of household biowaste (composted digestate; HBW-ADP)
- 1 plant composting paper sludge and green waste (PS_GW-CP)

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Parameters / methods I

- Heavy metals:

Cd, Cr, Cu, Ni, Pb, Zn	} aqua regia digestion	} ICP-MS
Hg		
- Organic contaminants:

PAH	} organic solvent extraction	} GC-MS	16 compounds	
PCDD/F			GC-HRMS	17 congeners
PCB			GC-HRMS	6 + 12 congeners
biphenyl			GC-MS	
PCP	} aqueous extraction	} GC-MS		
o-phenylphenol			} organic solvent extraction	GC-MS
bisphenol A		GC-MS		

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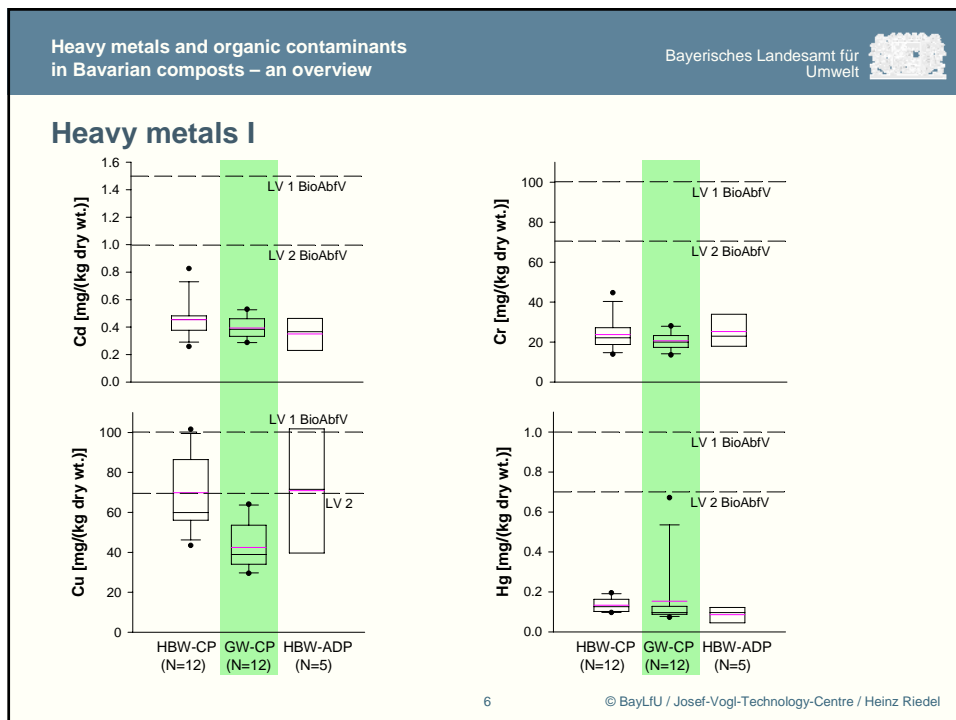
Parameters / methods II

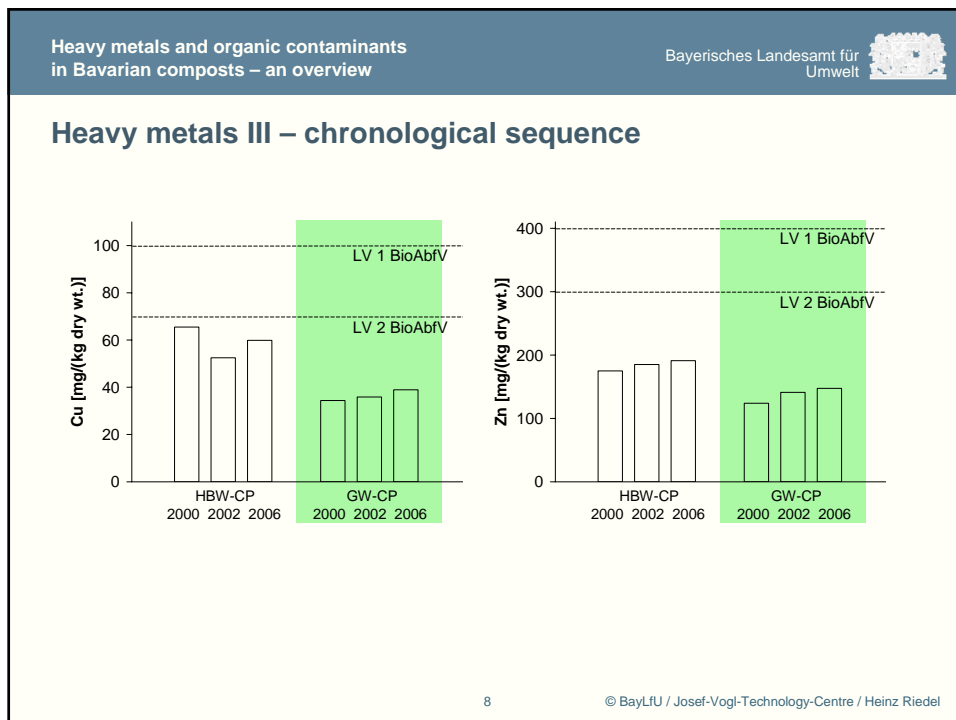
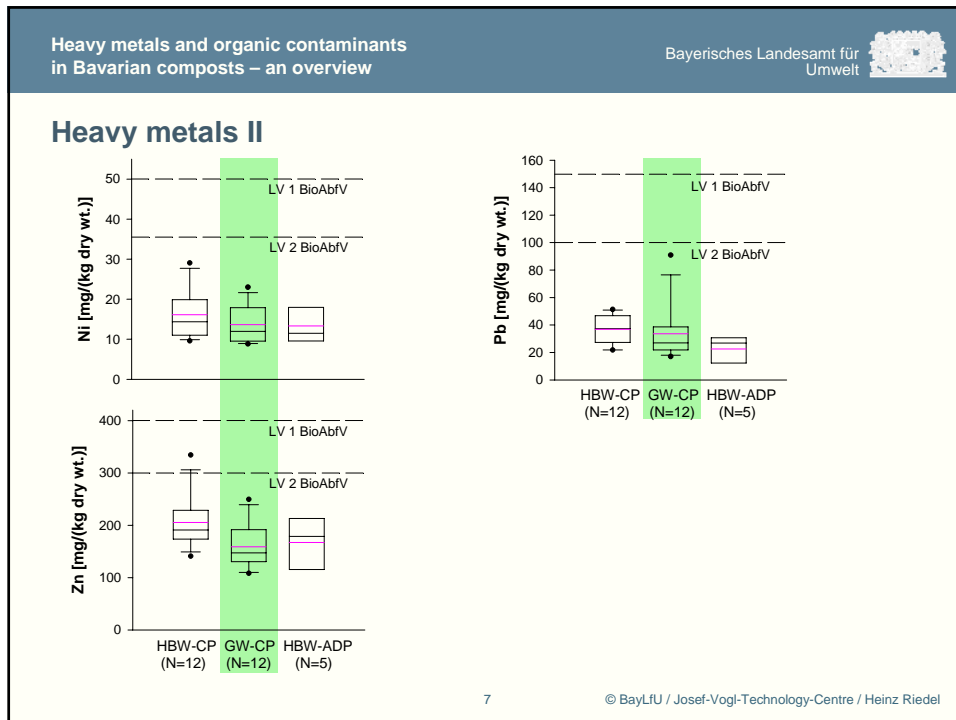
- Organic contaminants (cont'd):

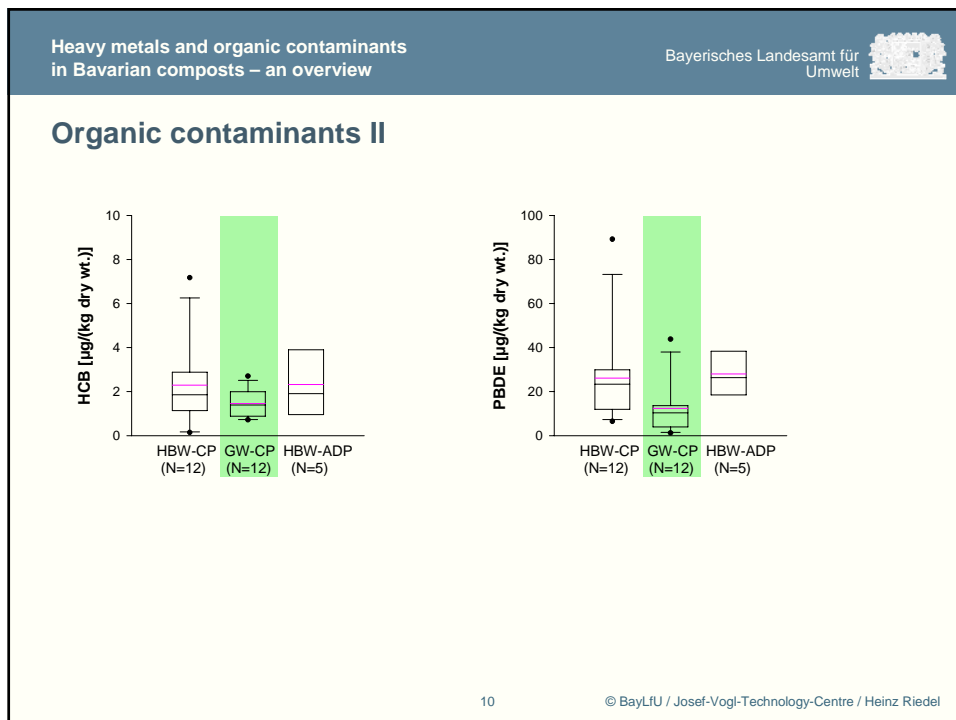
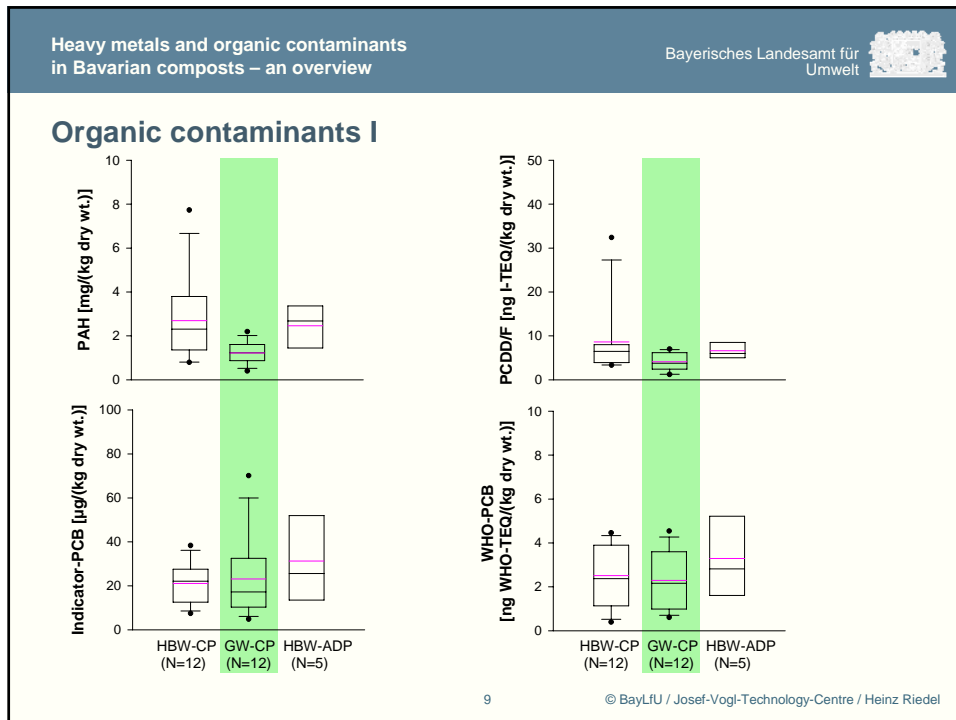
DEHP	} organic solvent extraction	GC-MS
i-nonylphenol		GC-MS
tin-organic compounds		GC-AED 8 compounds
Galaxolide® (HHCB)		GC-MS
Tonalide® (AHTN)		GC-MS
PBDE		GC-MS 8 compounds
thiabendazole		GC-MS
LAS ¹⁾		LC-MS/MS 7 compounds
PFT ²⁾		LC-MS/MS 2 compounds
triclosan ³⁾ , methyl-triclosan ³⁾		GC-MS

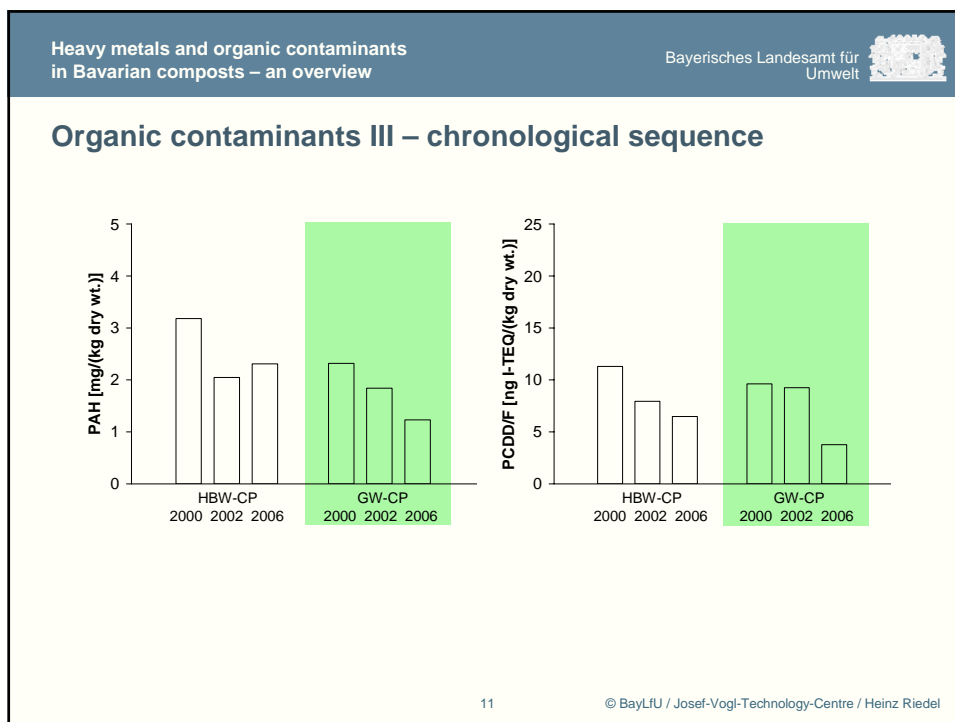
1) only samples from HBW-ADP
 2) only samples from 3 HBW-CP, 1 HBW-ADP, 1 PS_GW-CP
 3) only samples from 3 HBW-CP

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Organic contaminants IV – nonstandard substances

Contaminant	HBW compost (N=12)	GW compost (N=12)	Composted digestate of HBW-ADP (N=5)
[µg/(kg dry wt.)]		Median (min.; max.)	
PCP	15 (< 5; 37)	< 5 (< 5; 25)	15 (< 5; 29)
Bisphenol A	336.5 (< 10; 990)	10.5 (< 10; 43)	563 (23; 2860)
DEHP ¹⁾	1.15 (< 0.05; 2.69)	0.20 (< 0.05; 0.55)	1.76 (0.29; 4.75)
i-Nonylphenol	153.5 (< 50; 331)	< 50 (< 50; 87)	324 (< 50; 421)
Monobutyl tin	4.3 (< 1; 8.6)	< 1 (< 1; 6.4)	6.8 (3.4; 19.7)
Monooctyl tin	< 1 (< 1; 5.8)	< 1 (< 1; < 1)	4.8 (< 1; 10.6)
HHCB	13.7 (< 1; 46.3)	1.5 (< 1; 5.5)	62.2 (14.7; 69.8)
AHTN	8.7 (3.6; 16.1)	2.1 (< 1; 7.7)	9.2 (6.1; 16.8)

¹⁾ [mg/(kg dry wt.)]

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Summary

- Nearly all parameters detectable
except: some tin-organics, thiabendazole, LAS, PFT, methyl-triclosan
- Concentrations mostly low
except: Cu, Zn, PAH
- Contaminant level ranking: GW < HBW, HBW-ADP
- Temporal trends: inorganics behave ambiguously
organics seemingly decreasing

Report

- Schadstoffgehalte von Komposten und Vergärungsrückständen
Bayerisches Landesamt für Umwelt, Augsburg, 2007
http://www.bestellen.bayern.de/shoplink/lfu_abfall_00148.htm