

Landfill Behavior of Mechanical- Biological Pre-Treated MSW: Results of a Long Term Experiment

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Research Goals

➤ **1993: mechanical- biological pre-treatment as a alternative treatment technology to incineration**

➤ **Research Goals:**

➤ **to investigate the differences between mbp and tp MSW in terms of landfill behavior**

➤ **geotechnical parameters**

➤ **settlement**

➤ **leachate**

➤ **landfill gas**

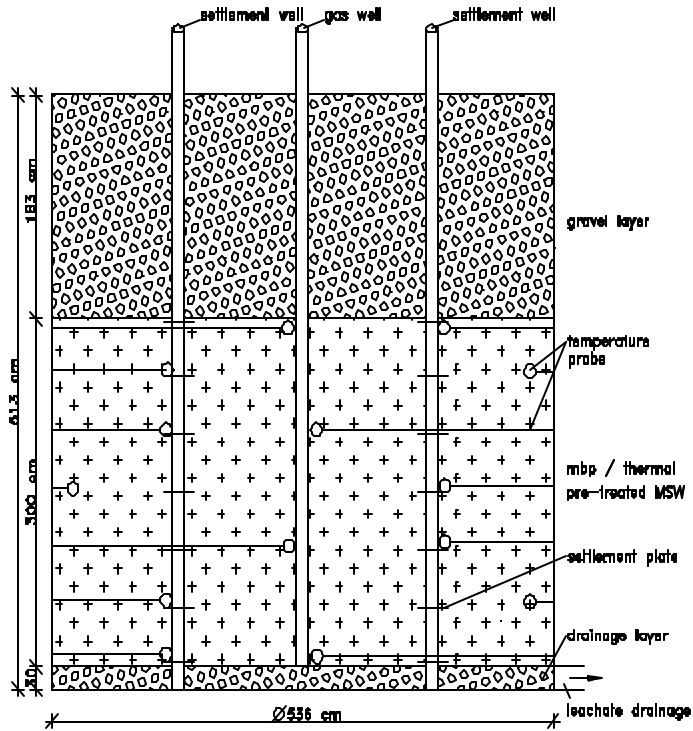
➤ **to focus on appropriate landfilling techniques and technologies for future MBP landfills**

➤ **leachate and gas collection / treatment systems**

➤ **cover liner systems**



Experimental Design 1993 - 1998



Waste Parameters for tp and mbp Waste 1993 - 1998

parameter	unit	tp MSW		mbp MSW	
		initial	final	initial	final
loss of ignition	[%DS]	5.11	5.05	26.32	23.50
dry density	[g/cm ³]	1.33	1.35	0.92	0.95
pore volume	[%]	45.43	44.50	55.82	54.15
relative settlement	[%]		0.11		4.89



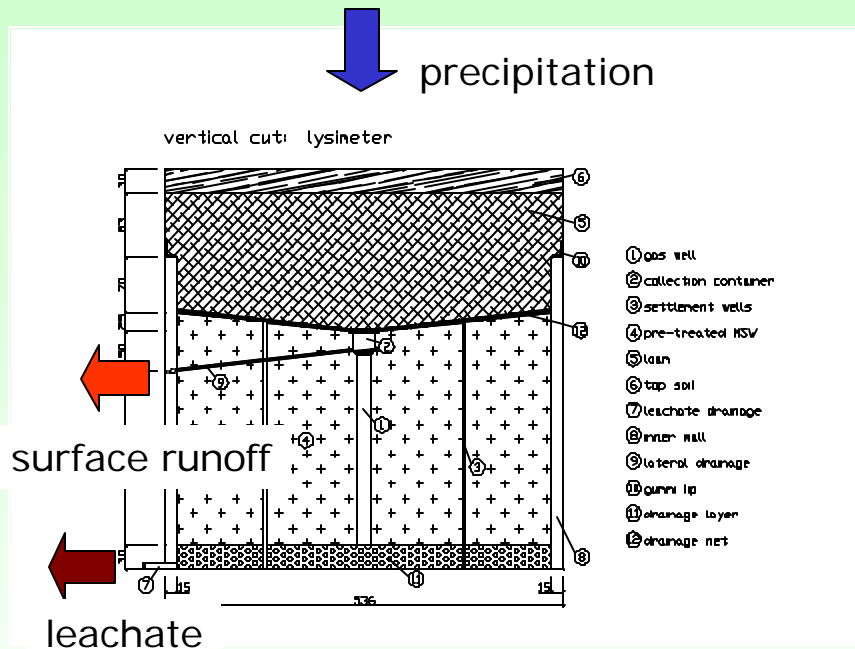
Leachate Concentrations for tp and mbp Waste 1993 - 1998

parameter	unit	tp MSW	mbp MSW
pH		6.6 – 12.0	7.0 – 9.0
chloride	[mg/L]	942 – 6079	670 – 2214
TOC	[mg/L]	5.2 – 97	106 - 853
COD	[mg O ₂ /L]	46 – 474	762 – 3043
lead	[mg/L]	0.01 – 0.1	0.01 – 0.1
nickel	[mg/L]	0.001 – 0.05	0.04 – 0.53

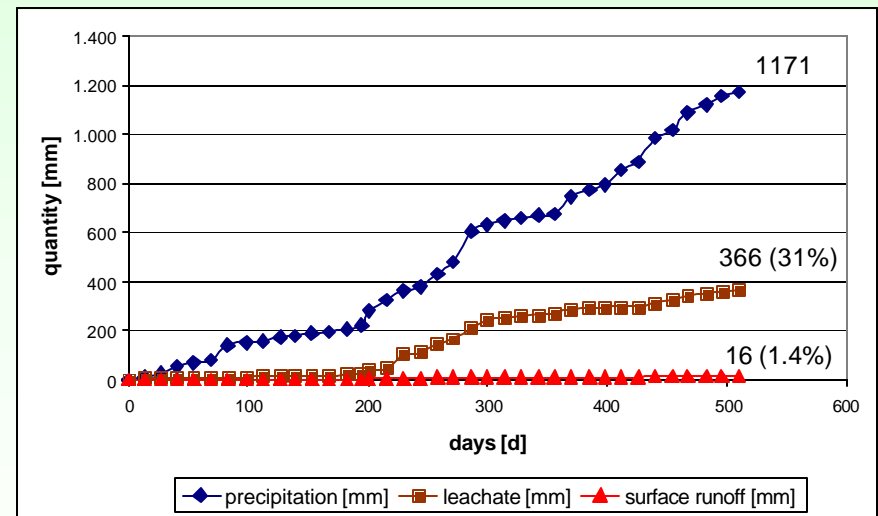


Lysimeter Water Balance 1998 - 2000

Schema of water balance in lysimeter



Quantity of precipitation, leachate and runoff versus time



Physical and Chemical Parameters - End of Project



layer	depth	k_f	K_o	TOC	AT_4	GB21
	[m]	[m/s]	[m ²]	[%TR]	[mg/gTS]	[nL/gTS]
A	0.7	1.13E-05	5.33E-12	9.70	3.9	0.26
B	1.1	3.15E-05	7.43E-12	10.80	5.3	0.16
C	1.5	8.85E-06	7.28E-12	13.30	3.6	0.95
D	2.2	2.98E-05	5.28E-12	14.00	3.3	1.66
E	2.6	2.05E-05	4.45E-12	10.80	3.6	n.a.
F	3.0	n.a.	n.a.	21.60	3.3	n.a.
Mix A-F				10.50	3.7	
AbfAbIV				≤17.00	≤5.00	≤20.00



Gas Concentration



	depth	CH4	CO2
	[cm]	[Vol.-%]	[Vol.-%]
cover layer	50	0.28	1.75
	100	0.28	2.27
	150	2.05	11.43
	200	14.06	25.30
mbp MSW	270	51.60	36.60
	300	57.05	33.63
	330	46.10	36.10
	350	51.65	37.15



Issues of MBP Landfill Operation

- **geotechnically stable landfill body**
- **problematic pore structure – low water and gas permeability in the landfill body**
- **effort to profile mbp MSW for surface water runoff during landfill operation**
- **stability problems can be caused by high pore water pressure –
design of leachate collection system**
- **low gas production and flow!**
- **are state-of-the-art gas collection and treatment systems required?**
 - **need for alternative gas/leachate collection systems**
 - **methane oxidation techniques in biofilters**
- **feasible cover layer design**



Conclusions

- German landfill regulations for MBP landfills after 2005
- landfill behavior
 - geotechnically stable landfill body
 - 90 – 95% reduction of the organic leachate concentrations
 - very low gaseous emissions with high gas concentration profile
- MBP landfill technique
 - leachate generation similar to regular MSW landfill
 - need for a gas/leachate collection system
 - alternative gas treatment methods
- mechanical biological MSW treatment prior to landfilling is a viable alternative to incineration techniques



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