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Forced aeration under a landfill cover

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Reduction of methane emission by forced aeration and extraction

mechanisms:

- **improved activity of oxidizing microorganisms**
- **inhibition of methane formation**
- **reduction of formation potential by aerobic degradation**
- **very intensive gas extraction**

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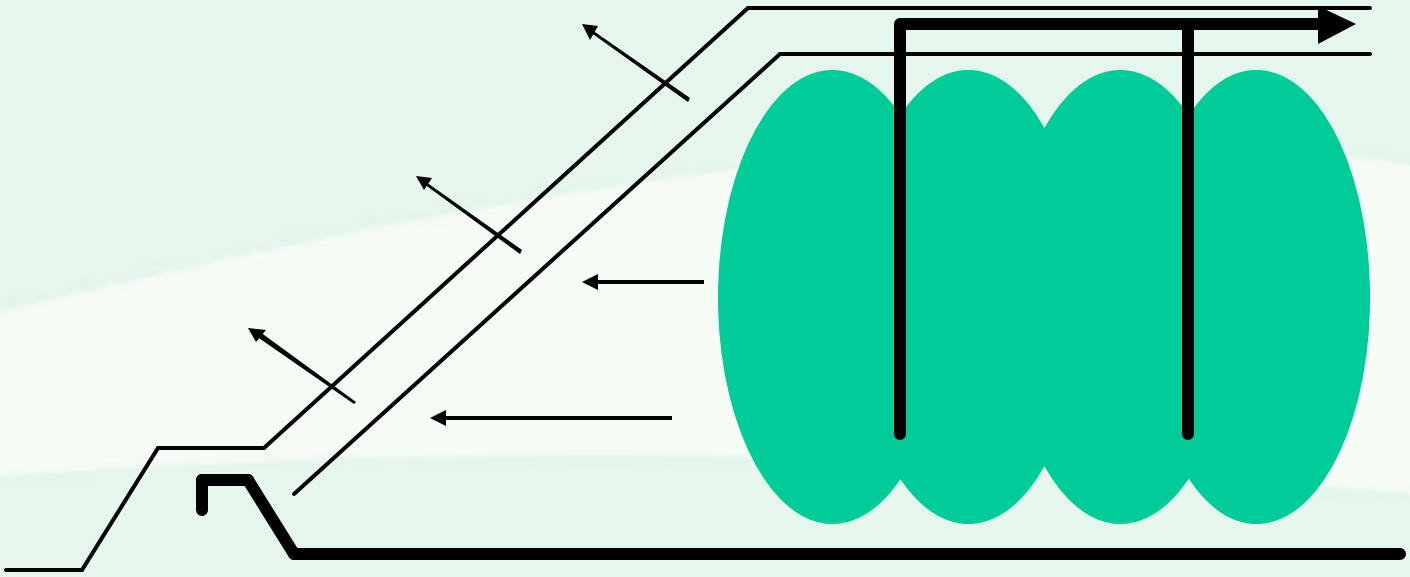
Lateral emission



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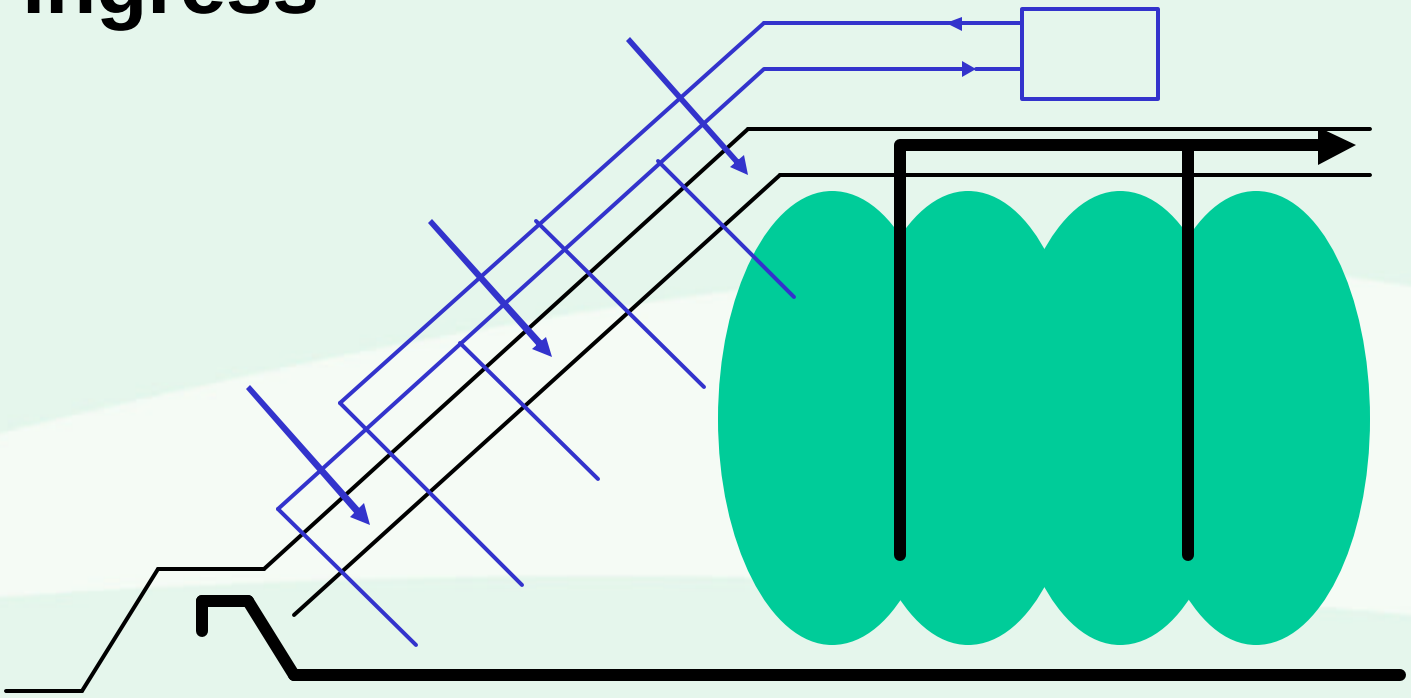
Aeration and extraction net ingress



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Methane emission measurements

- entire landfill: mobile plume method
- landfill cell: mass balance method
- aeration area: box measurements

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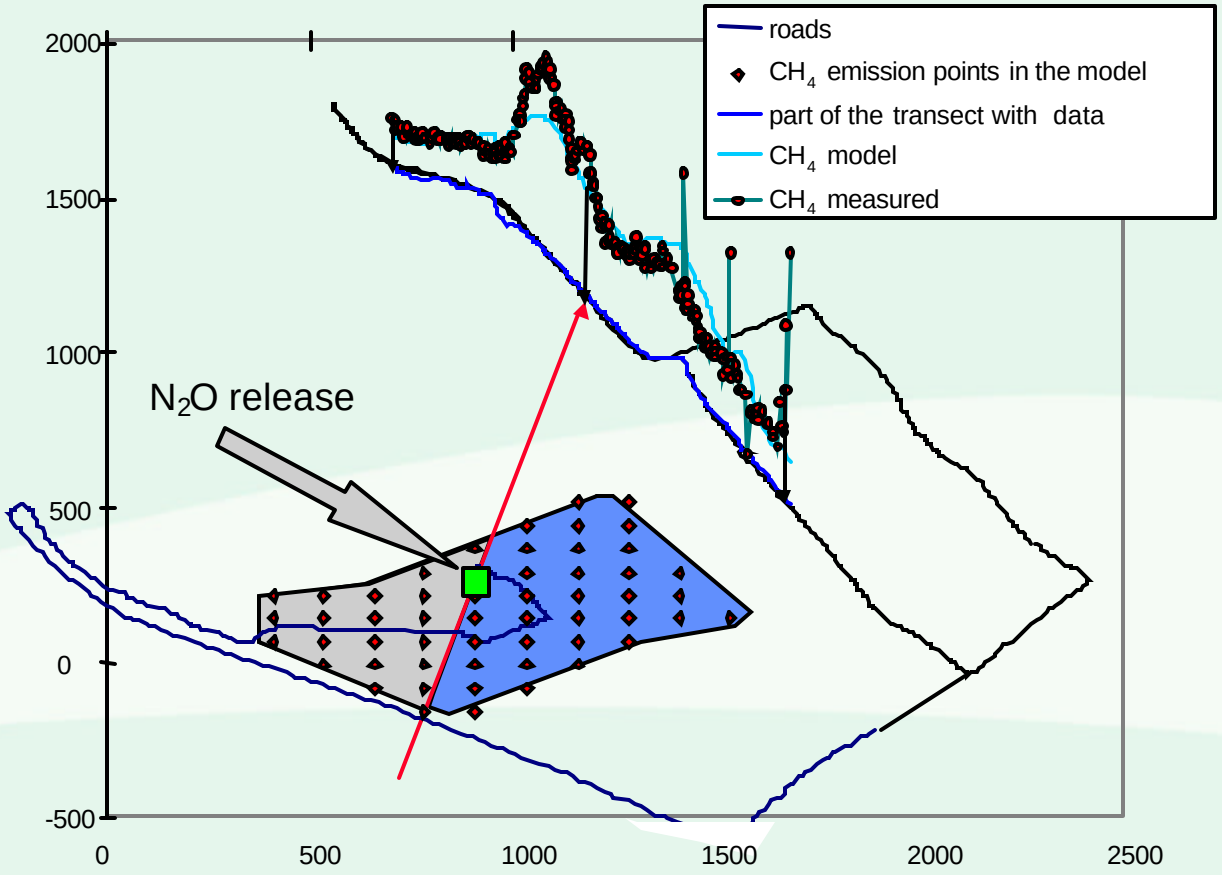
TDL plume measurement



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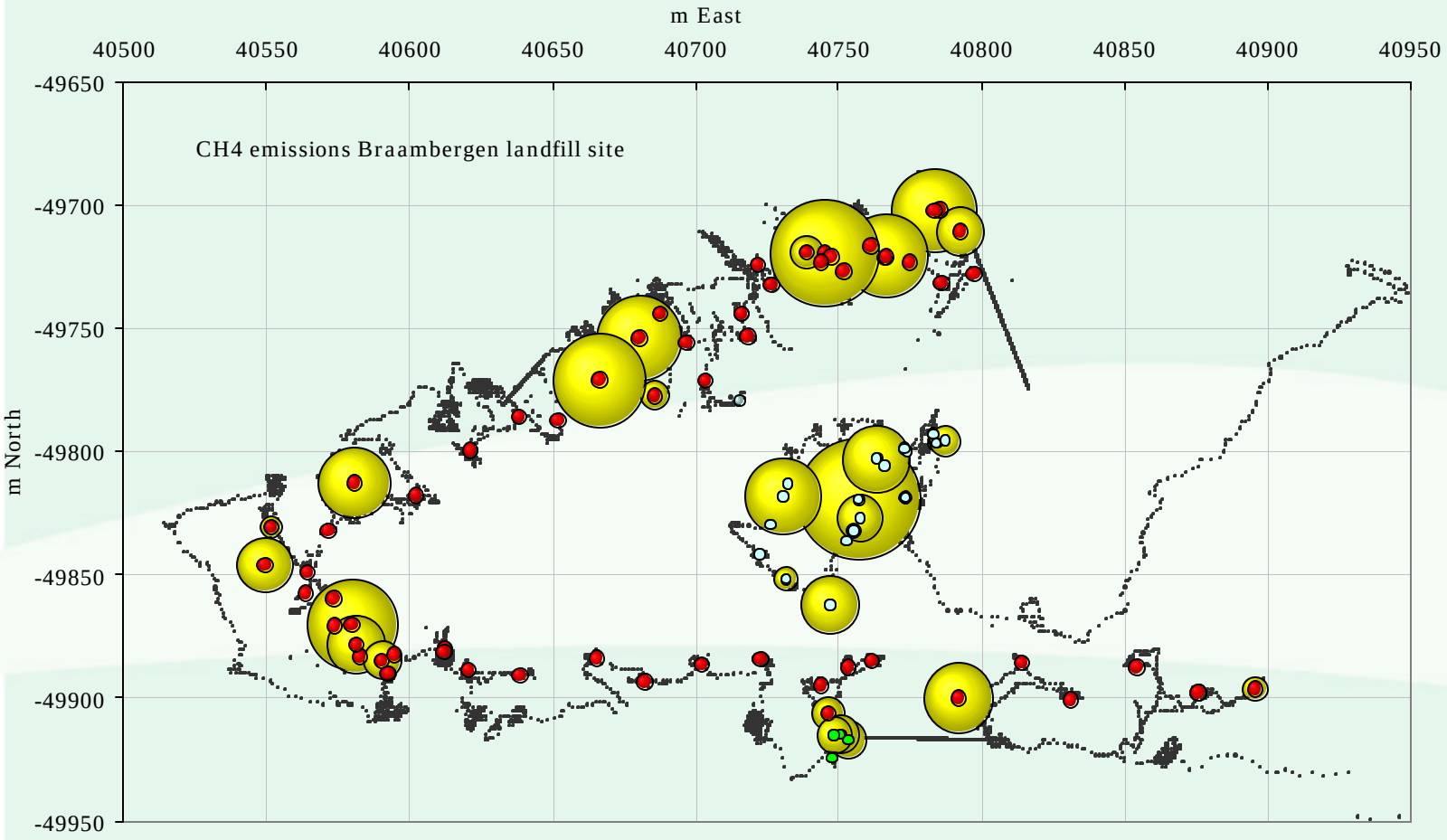
Box/TDL measurement



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Braambergen (m^3 $CH_4.h^{-1}$)

Period	Method	Production modeled	Emission measured	Extraction measured	Oxidation estimated
11/1999	TDL	250 ± 50	240 ± 40	110	?
11/2000	TDL	380 ± 80	240 ± 24	245	?
11/2000	TDL	7,0 ha	160 ± 16		
11/2000	MBM	5,5 ha	185 ± 9		
11/2000	box	2,0 ha	224 ± 100		
02/2001	MBM	5,5 ha	118 ± 9		
02/2001	box	2,0 ha	22 ± 21	97 ± 19	55 ± 21
08/2001	MBM	5,5 ha	80 ± 9		
08/2001	box	2,0 ha	32 ± 20	78 ± 13	55 ± 21
08/2001	box/TDL	2,0 ha	13 ± 12		
01/2002	MBM	5,5 ha	95 ± 10		
05/2002	MBM	5,5 ha	63 ± 7		

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Waste characterisation

- methane oxidation capacity
- biological stabilization
- pilot scale stabilization

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Methane oxidation capacity

oxidation capacity	[l/m^2/hr]		number of
	average	min – max	samples
top cover soil (0-30 cm)	3.0	0.3 – 5.9	8
top cover soil (> 50 cm)	2.0	1.0 – 3.8	6
waste (> 100 cm)	0.1	0 – 0.7	6
Börjesson et.al. (1997)		0.2 – 3.3	
Figueroa (1993)		0.7 – 5.6	

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Biological stabilisation

respiration index, dry matter, organic dry matter

aspect		norm (D, A)	waste sample	pilot
$RI_{4,\ max}$	[mg O_2/g dm]	5,0	5,7 ± 1,7	40,4
$RI_{4,\ end}$	[mg O_2/g dm]	5,0	1,6 ± 1,8	0,7
dm_{before}	[g / kg_{wet}]		637	564
dm_{after}	[g / kg_{wet}])			549
odm_{before}	[g / kg_{wet}]		119	184
odm_{after}	[g / kg_{wet}]			167

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Leachate characterization

- before aeration eluate fully reduced
- remarkably consistent sample results
- porewater sample DOC during aeration indicates increased degradation
- leachate quality does not change drastically after aeration

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Concluding remarks

- aeration significantly reduces methane emission
- intensive LFG extraction most important mechanism
- need for cost-effective oxidation of low methane LFG
- oxidation does not significantly increase leaching