New Technology to Enhance Methane Oxidation at Landfills

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Introduction

The aim of this study and technology is to utilize methane oxidation capacity of the landfill cover also at the sites where infiltration is avoided with sealing top cover. The key idea of the technology is to discharge landfill gas through the sealing layer via landfill gas wells not directly to the atmosphere but to the drainage layer. In the experimental field 1 simply impermeable plastic film was installed above the gas well in order to prevent gas flow directly to the atmosphere (Fig 1). In the experimental field 2 (Fig. 2) landfill gas is delivered all over the field and through the oxidising top cover layer via plastic well and radial perforated pipes. No pumps are needed.

Seven measuring periods were carried out in 2000-2002. Methane concentrations were measured from 121 sampling points with a flame ionization detector (FID). In addition, the gas concentration in the landfill cover was measured from four locations at the surface, 30 cm, 50 cm, 70 cm and 100 cm below the surface.

Results and discussion

Homogeneity of the top cover has to be taken care of in order to avoid shortcuts of the gas. 747 FID measurements were made and only in 15 cases methane concentration in the gas flow through the top cover was higher than 100 ppm. Based on the methane and carbon dioxide measurements at different depths effective methane oxidation was found also in December with low temperature in the landfill cover. Cost 5.000-10.000 $/ ha of the gas

oxidation system includes doubling the amount of the wells and structures to deliver gas in the drainage layer.

Conclusions

The new landfill gas distribution system via drainage layer can be effectively used to utilize methane oxidation capacity of the topsoil also at the site equipped with impermeable cover sealing. The cost of the system is low compared to separate biofilters and flares. The new landfill gas oxidation system can be applied at small landfill sites equipped with impermeable sealing when the landfill gas amount is small or methane concentration is too low for active gas recovery and combustion.

Fig.1. Schematic picture of the new landfill gas oxidation system; (1) refuse, (2) impermeable sealing layer, (3) drainage layer, (4) top soil cover, (5) gas collection system, (6-8) distribution well through the sealing and (9) impermeable liner to prevent gas flow.
PCT patent pending

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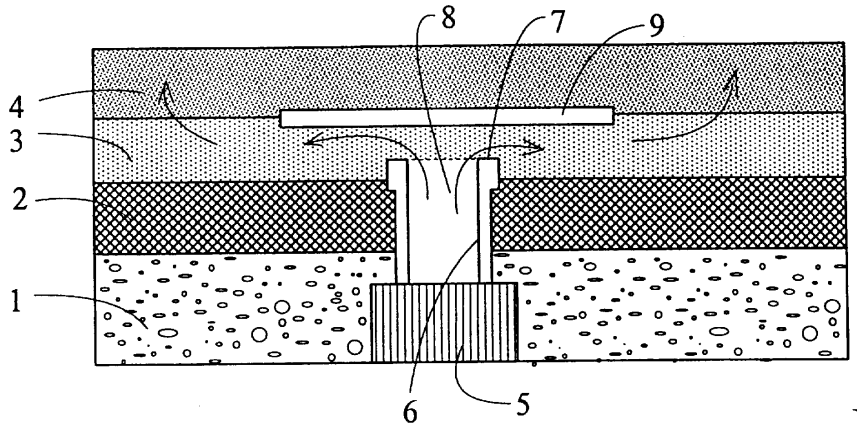

Fig. 1

Fig 2. Schematic picture of the new landfill gas oxidation system. Patent pending.

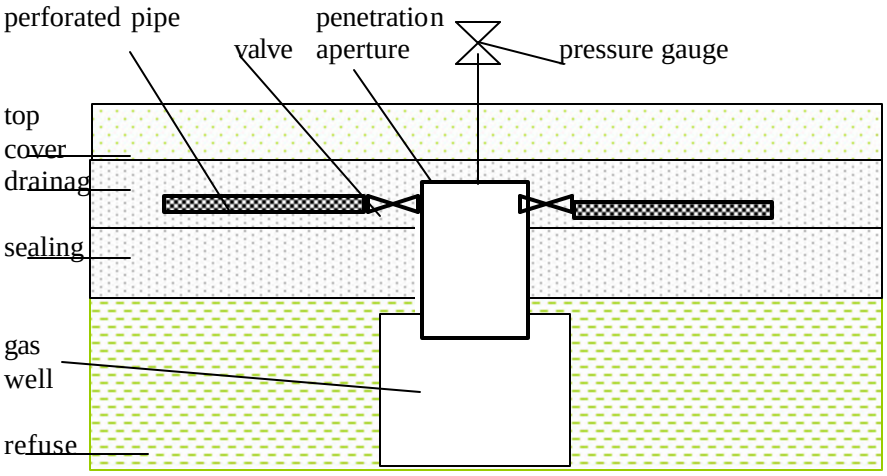

TABLE 1

Distribution of methane concentrations at Koivissilta experimental field 1, n=605

Period	0-10 ppmv	11-100 ppmv	101-1000 ppmv	>1000 ppmv
May 2000	117	3	1	0
September 2000	110	5	4	2
December 2000	116	2	3	0
May 2001	118	1	2	0
August 2001	116	2	0	1
All	**577**	**13**	**10**	**5**

TABLE 2

Distribution of methane concentrations at Koivissilta experimental field 2, n=142

Period	0-10 ppmv	11-100 ppmv	101-1000 ppmv	>1000 ppmv
May 2001	105	16	0	0
August 2001	19	2	0	0
Both	**124**	**18**	**0**	**0**

TABLE 3

Methane concentration at 0-100 cm depth at Koivissilta experimental field 1 in September 2000, all values ppmv

Depth cm	Measuring point 1	Measuring point 2	Measuring point 3	Measuring point 4
0	40	120000	1	23
30	210	420000	30	150000
50	5900	480000	136	70000
70	7800	500000	1000	440000
100	480000	510000	60000	550000

TABLE 4

Methane concentration at 0-30 cm depth at Koivissilta experimental field 1 in in December 2000 with **temperature 2-6 ^{o}C** in the landfill cover ,

all values ppmv

Depth cm	Measuring point 1	Measuring point 2	Measuring point 3	Measuring point 4
0	35	< 2	< 2	< 2
10	540	4	< 2	< 2
20	8000	45	< 2	< 2
30	10000	3000	< 2	< 2