

Emission measurements as a tool to improve methane emission estimates

Heijo Scharff, Hans Oonk, Arjen Hensen, David van Rijn



Contents

- Goal of the project / Sardinia 2001 Workshop 4
- Three measurement approaches
- Results
- Validation of models
- Concluding remarks

Goal: to improve LFG emission estimates

- National government interest: targets for GHG emission reduction require measures, selection & implementation require accurate estimates, evaluation requires monitoring.
- Landfill operator interest: quantification and reduction of emissions, design of measures.

Sardinia 2001 Workshop 4:

LFG emissions are highly variable

- Spatial variation: slopes, hot-spots (factor 1,000)
- Hourly and daily variation: depressions, rain (factor 2 - 10)
- Seasonal variation: oxidation (factor 2 - 10)
- Other aspects: type of waste, management practice, ...

Suitability of a method depends on the purpose of the measurements

- Leaks in top cover or malfunction of extraction system: vegetation damage, soil properties, thermography.
- Part of a landfill (e.g. test cell experiments): flux box methods.
- Entire landfills:
Tracer (plume) measurements considered most reliable for single moment measurement. But expensive.
- Need to test and validate formation and emission models.

Targets for measurement methods

- Sufficient temporal resolution
(for annual average: 4 times 3 weeks)
- Sufficient spatial resolution
(most suitable: mass balance and plume methods)
- Measure both methane and carbondioxide
- Possibility for automation / operation by landfill personnel
- Affordable (max. 10,000 Euro for annual campaign)
- "Calibration" by means of $d^{13}C$, TDL, FTIR, ...

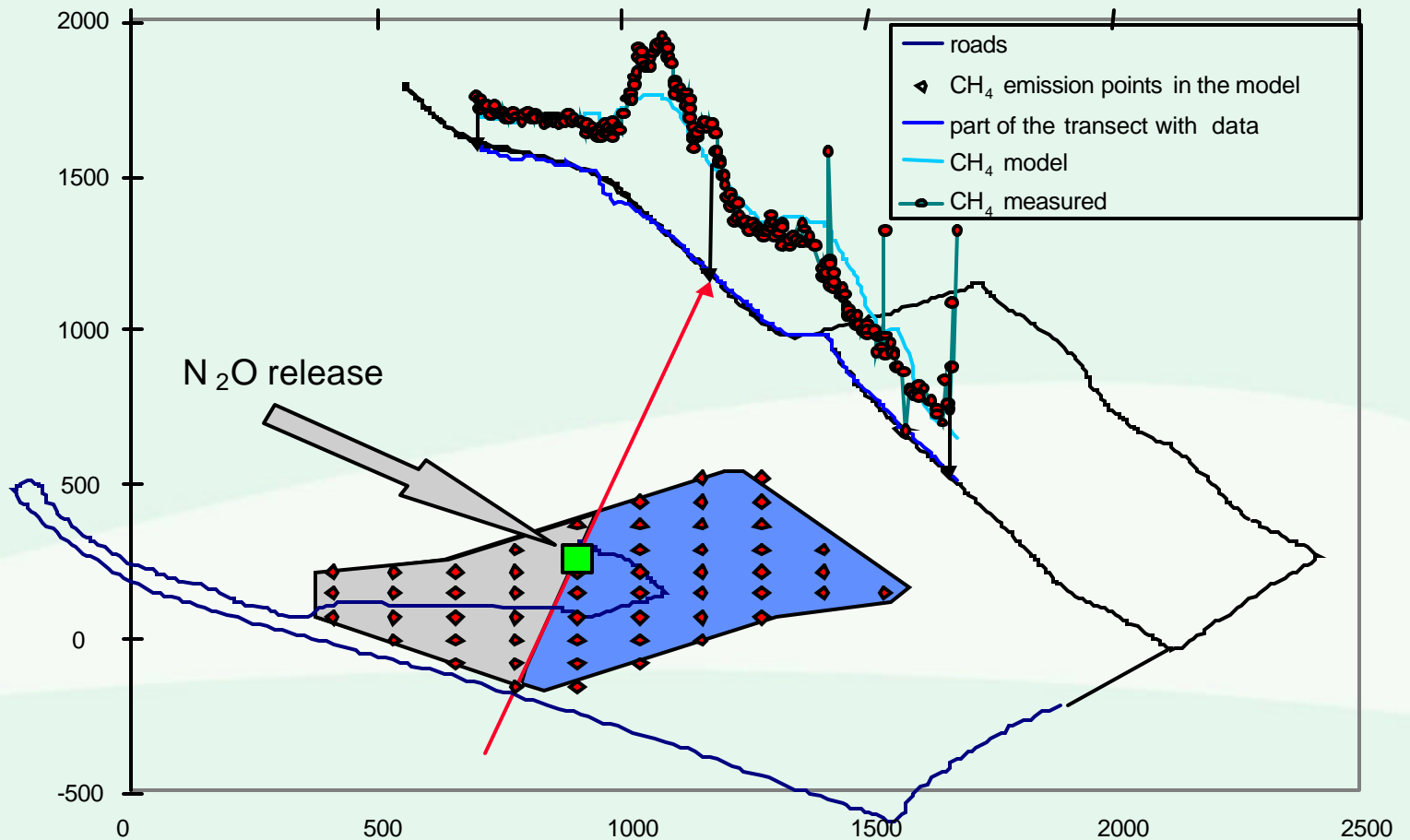
TDL-System



TDL-System



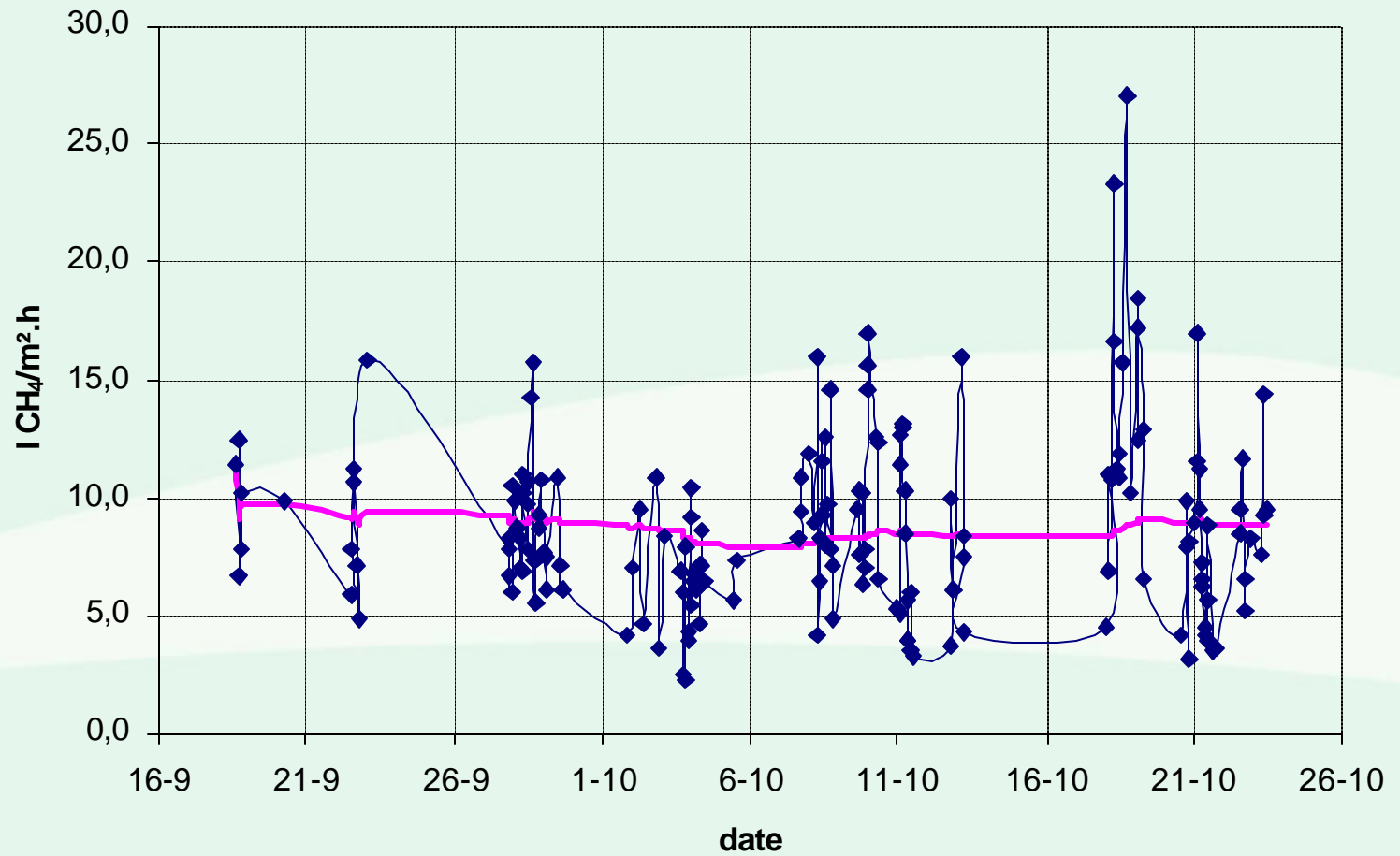
Methane plume at Braambergen November 13, 2000



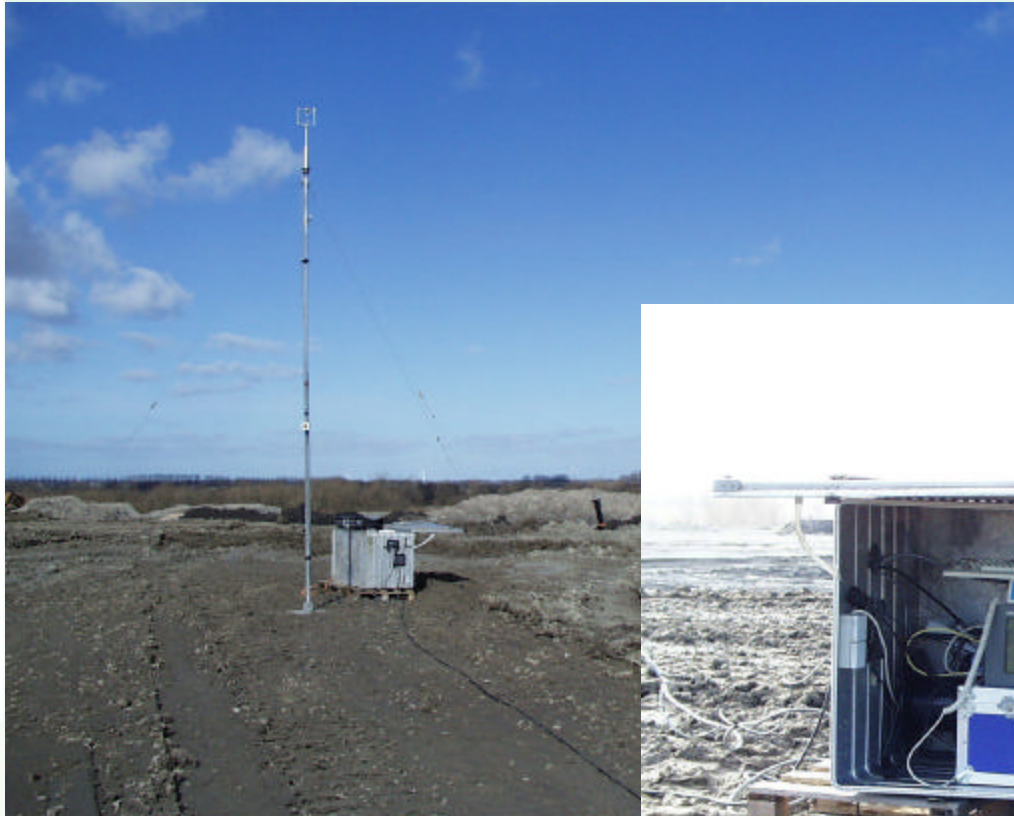
MBM - System



MBM measurement



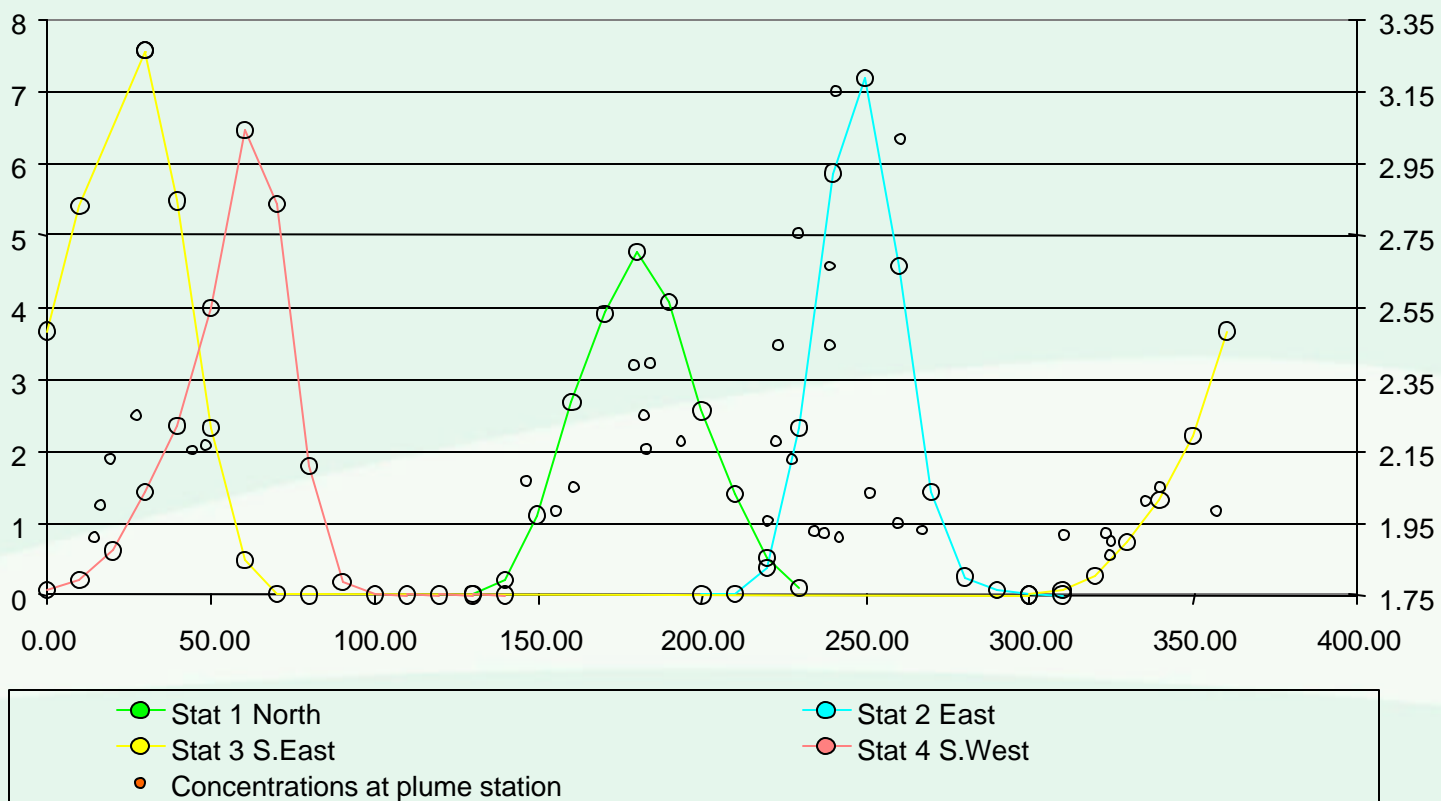
SPM - System



SPM - System



Nauerna expected SPM-"plumes" & observed conc.



Operational aspects

- MBM: operation is easy and reliable;
simple enough for landfill operator;
calculation is straightforward;
expensive analyser requiring climate control;
high power demand.
- SPM: no expensive analyser in the field;
many samples required, many were lost;
collecting samples requires a lot of time;
sampling control needs improvement;
complex modelling (comparable to TDL).

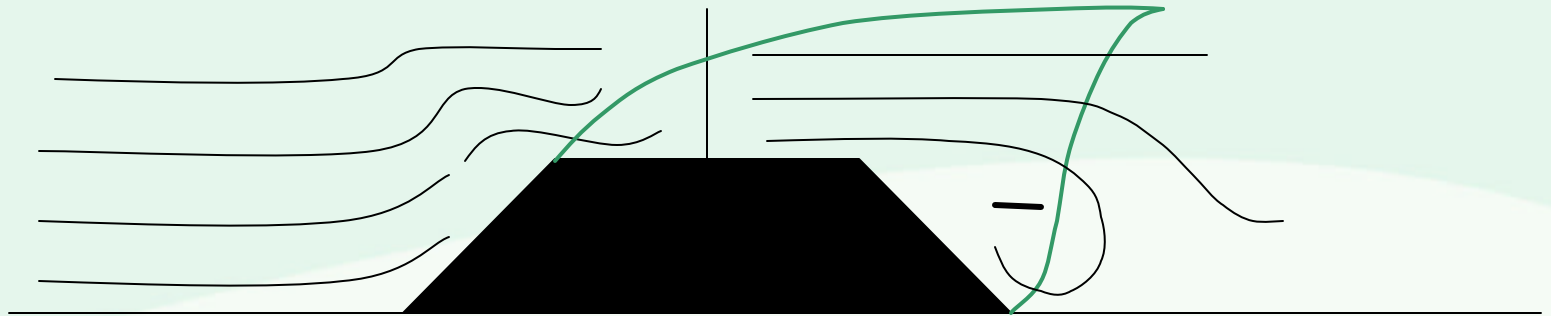
Measurement results

Landfill	Nauerna	Braambergen	Merwedehaven	Wieringermeer
Surface m ²	720,000	296,000	350,000	180,000
Waste Mton	7.7	1.7	5.3	1.6
Emission MBM	527 ± 25%	109 ± 25%	386 ± 25%	83 ± 25%
SPM	750 ± 780	440 ± 240	820 ± 700	227 ± 194
1 st TDL	1,400 ± 370	540 ± 108	390 ± 100	166 ± 43
2 nd TDL	900 ± 150			
3 rd TDL	496 ± 222			

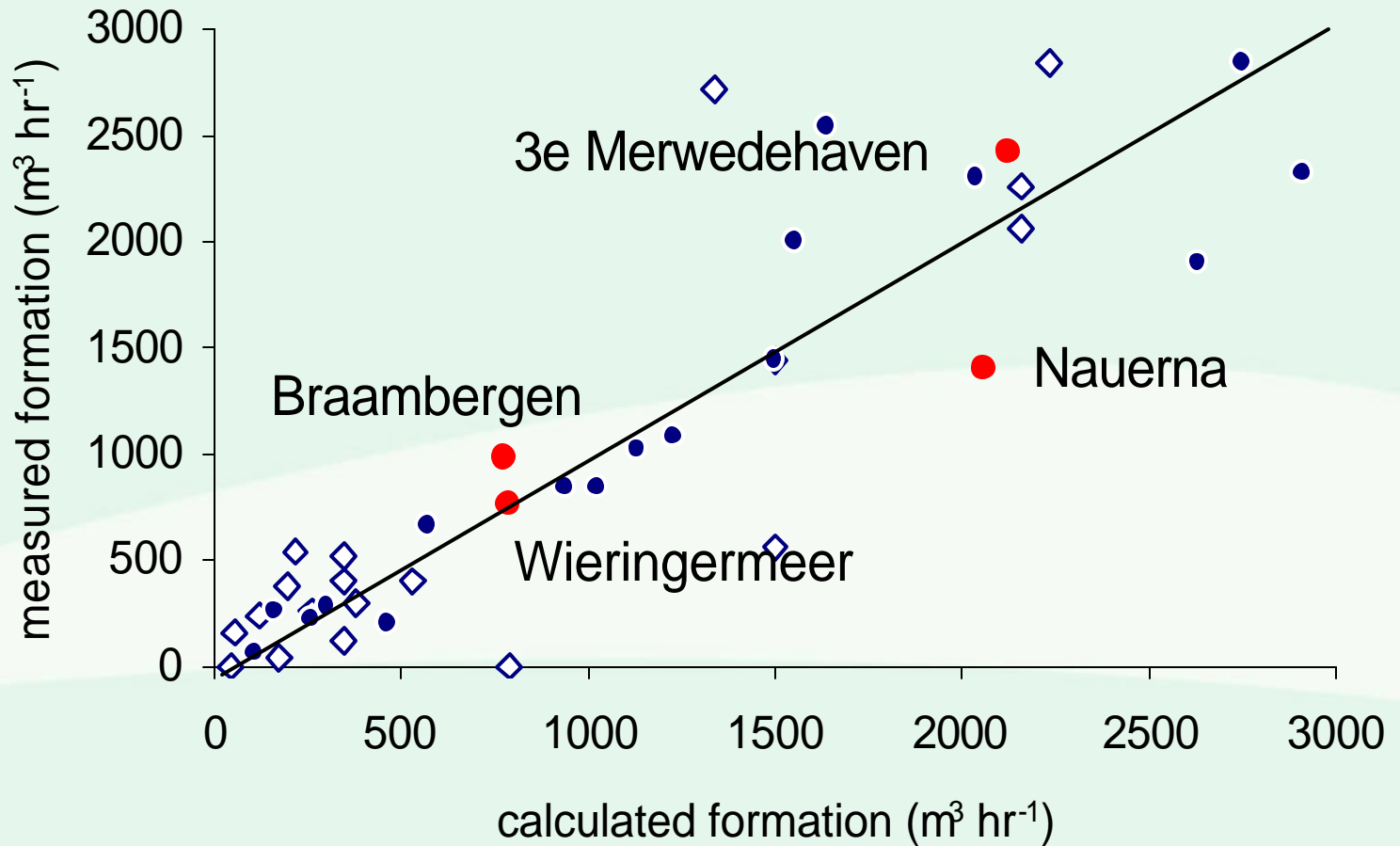
Comparison of results

- SPM and TDL results in the same order of magnitude
- Both methods: inaccuracy large
- MBM inaccuracy comparable with formation models
- MBM results considerably lower than both SPM and TDL
- Inaccurate background concentrations? Leeward side?

Leeward side



Validation



Concluding remarks

- Made progress in development of measurement methods
- MBM: fundamental questions
- SPM: equipment needs improvement
- Simpler and cheaper analysers (sensors) required
- Measurements can be used to validate formation models
- Models and measurements have similar inaccuracy
- Impediment: lack of waste quality data