

# Analysis of landfill gas migration using autonomous gas monitoring platforms

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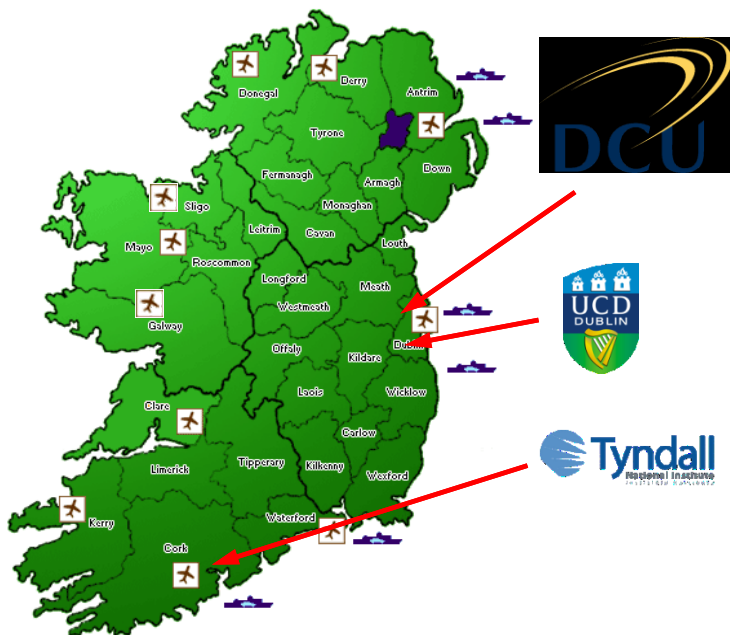
Dublin 9, Ireland

ICSW 2012: Philadelphia, PA. 12<sup>th</sup> March 2012

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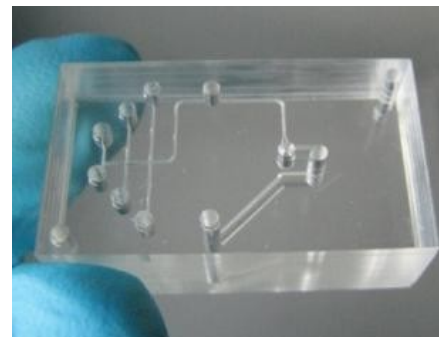
www.clarity-centre.org www.dcu.ie/chemistry/asg/



Gas sensing



Water sensing



Adaptive Sensors Group





# Motivations



Kerdiffstown, Kildare: Jan/Feb 2011

1. Reduction in greenhouse gas pollution<sup>[1, 2]</sup>
2. Optimised management /utilisation of gas-generative sources
3. Eliminate hazardous, costly and controversial social risks  
- €33M landfill fire clean-up in Irish midlands <sup>[3]</sup>

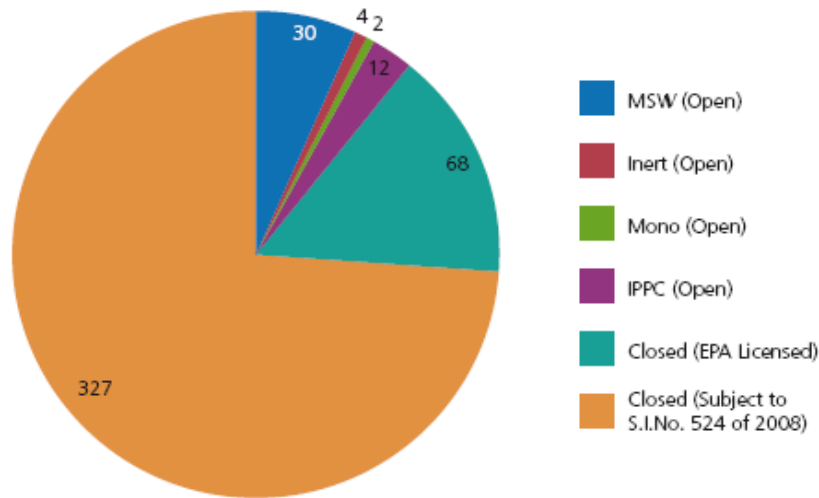
[1] Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe, E.P. and C.E.U., 2008.

[2] Kyoto Protocol, Information Unit on Climate Change, U.N.,1998

[3] SKM Enviros, Appendix 7: Cost scenarios. Eval. env. liabilities at Kerdiffstown landfill. Available online: <http://www.epa.ie/downloads/pubs/other/envlia/ker/> (accessed 29 July 2011).

# Landfilling in Ireland

Number of landfills by type in 2009



## The numbers:

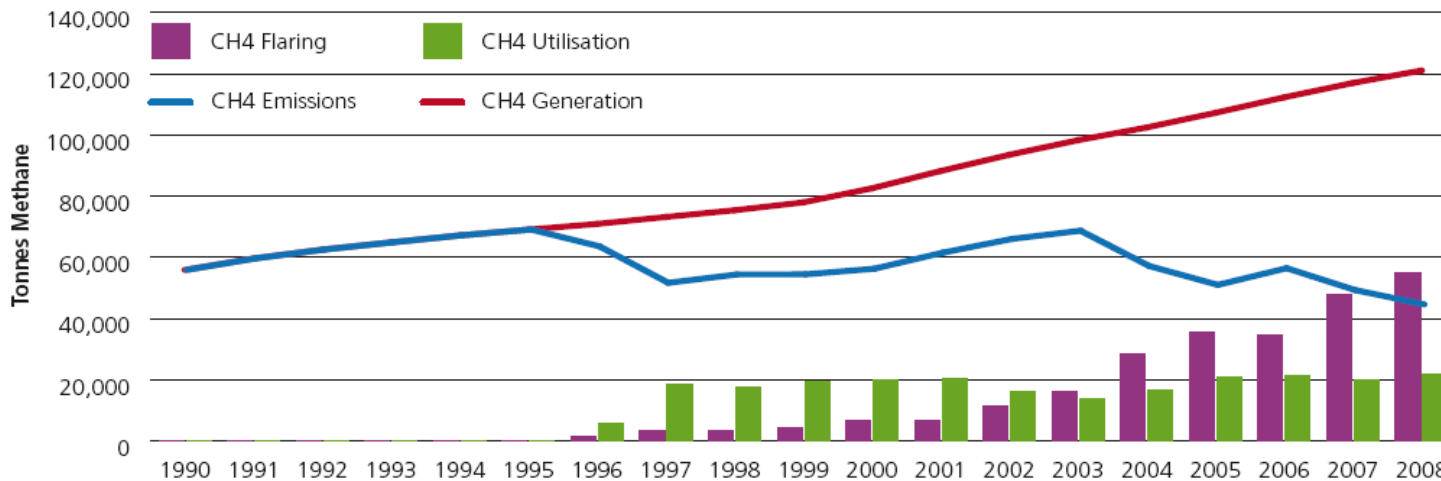
National rate: 2 million tonnes per annum (2008) =  
~1.2 kg/person/day

48 open facilities

Maximum landfill capacity will be reached in 2020

Odorous landfill gas accounted for ~71% of all complaints in relation to licensed facilities (2009)

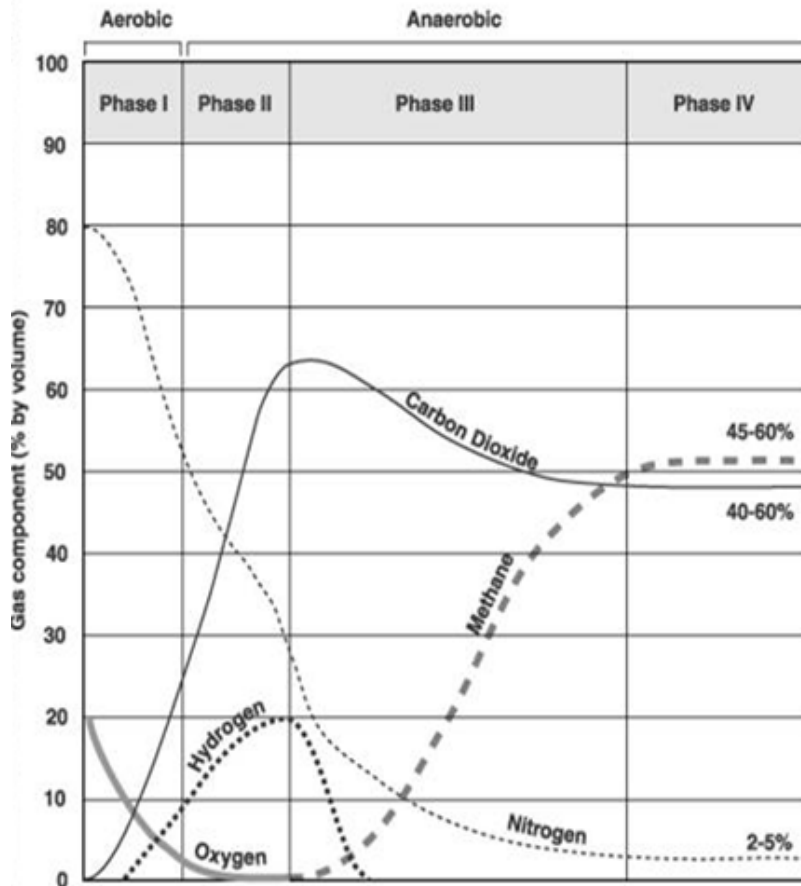
Methane emissions from landfill 1990-2008<sup>45</sup>



Source: Focus on landfilling in Ireland. The Environmental Protection Agency. 2010

# Landfill gas generation

Magnitude dependent on numerous factors: age, waste type, environmental conditions...



Generated gas is extracted for flaring or power generation (if  $\text{CH}_4 > 50\%$  vol.)

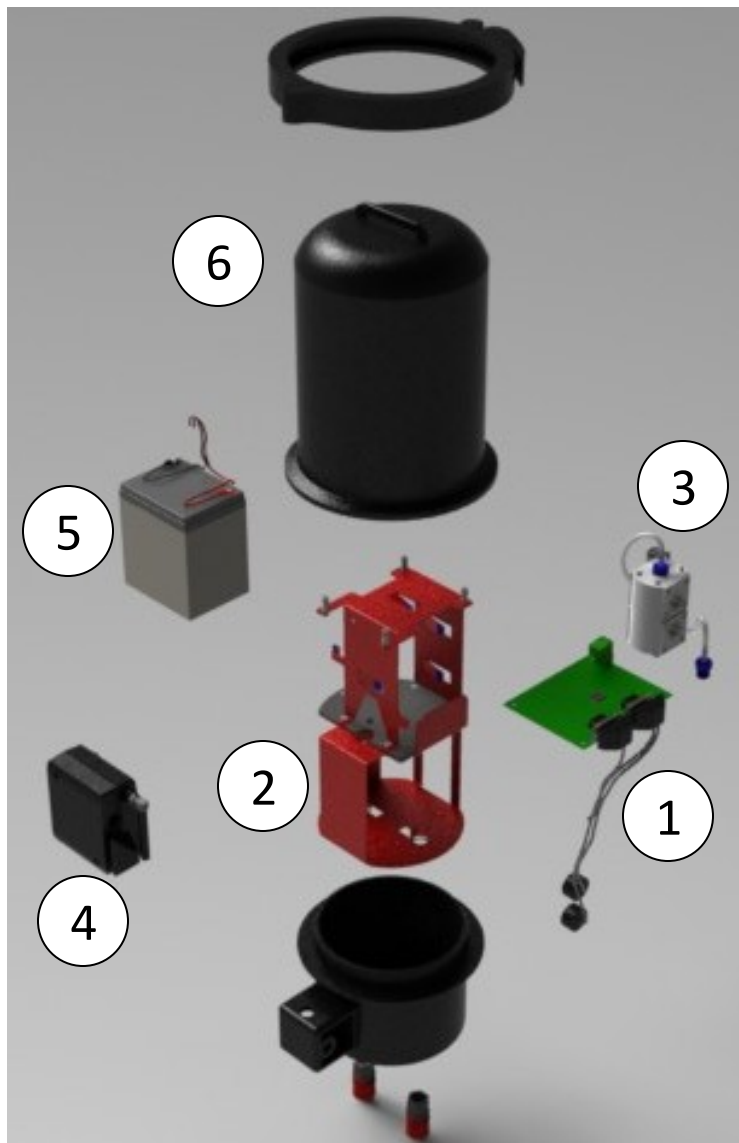
Gas migration measured in perimeter borehole wells:

→ threshold limits of 1.0% / 1.5% vol. for  $\text{CH}_4$  /  $\text{CO}_2$





# Platform technology



## Components:

1. Microcontroller circuitry
2. Gas extraction
3. Infrared CH<sub>4</sub> and CO<sub>2</sub> gas sensors
4. GSM communication
5. 12V 5Ah lead acid battery (10 weeks @ four samples/day)
6. IP68-rated weatherproof casing

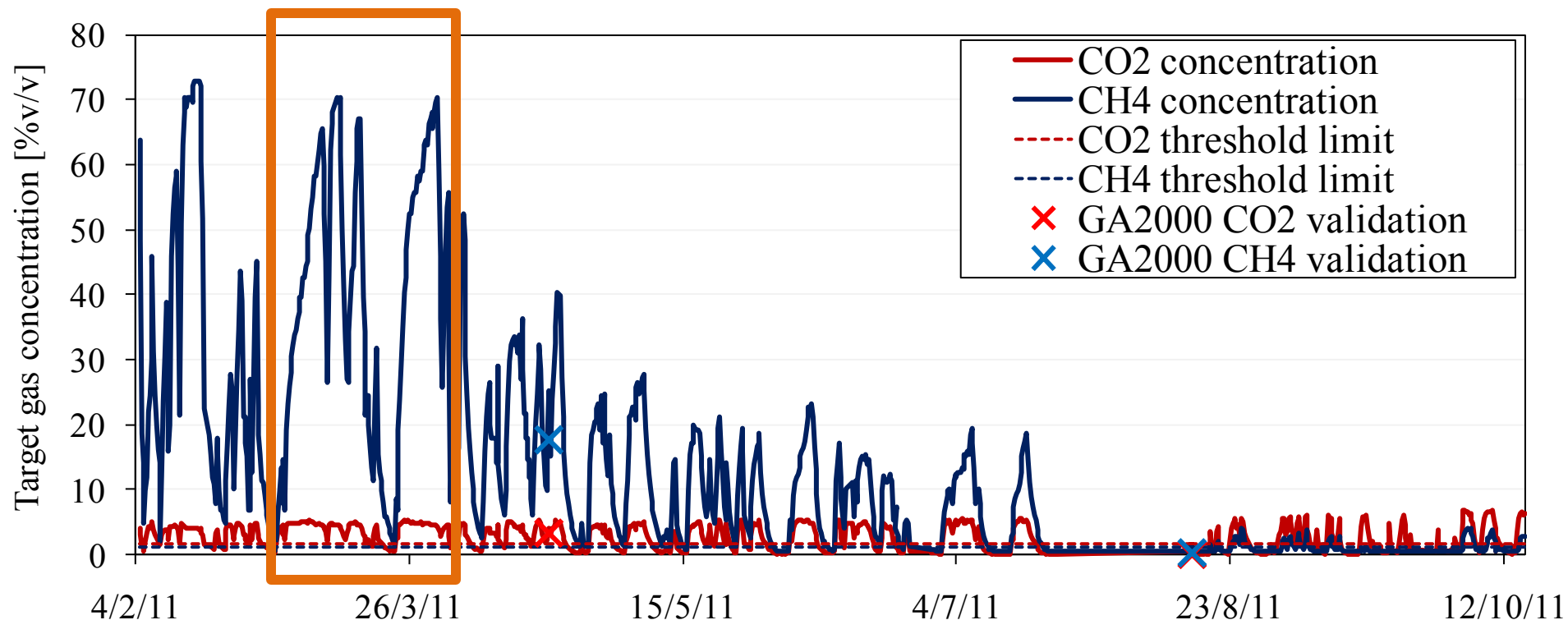


# Data access





# Landfill gas monitoring



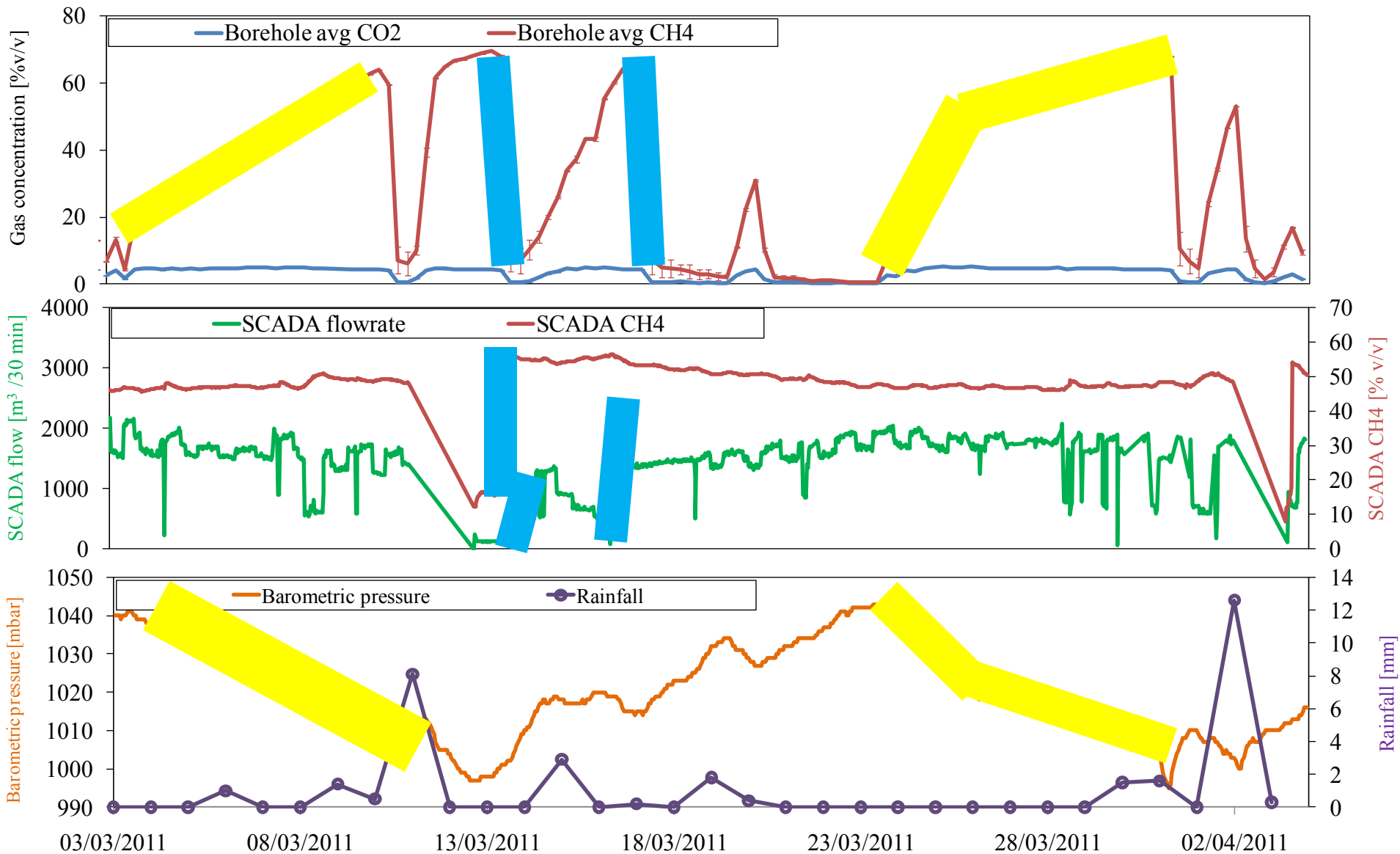
## Duration

- **253 days/6072 hrs**
- **890 measurements**

## Validation checks with GA2000

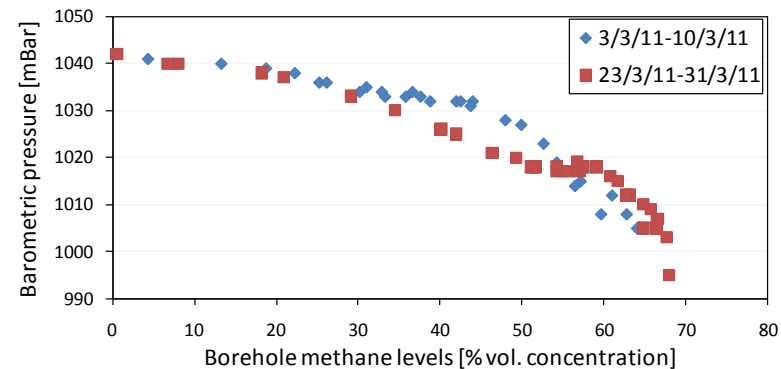
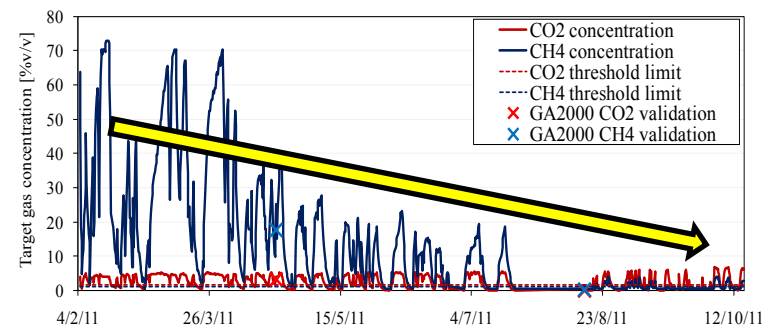
on 20/04/11, 16/08/11, 16/10/11  
> 98 % accuracy for all checks

# Data analysis



# Data conclusions

- Overall reduction in gas levels over the monitoring period
- Gas levels ↓ with increased extraction
- Gas levels ↑ when barometric pressure ↓ and rainfall ↑
- Positive feedback from regulators and operators in terms of data accessibility and usefulness





# On-going work...



- Distributed network of multiple platforms
- GEN3 development (cost reduction, power longevity, modularity in sensors and comms)
- Commercialisation



technology from ideas



# Thank you for you attention

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