

PROJECT OUTLINE

Project Title

Enhancing the design and application of wind tunnels for measuring odour emissions from area sources

PhD Supervisor

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Project Summary

Odour emissions have the potential for significant impact on the public, and as such have increasingly become an issue for businesses and a key area of concern for regulatory bodies. Sample collection and subsequent measurement is a cornerstone of the process of assessing odour impacts and designing/evaluating abatement processes. Area sources (such as detention ponds, landfills, and biofilters) offer significant challenges with regards to collecting representative odour samples. The design and application of wind tunnels (one of the common area source sampling techniques) is currently highly variable, with little standardisation and minimal performance evaluation. This project will investigate the design and operation of wind tunnels using a combination of tracer compound based performance testing and fluid dynamic modelling to understand the key issues related to these systems and provide guidance to enhance the design and operation of wind tunnels used for odour sampling.

Background

While many industrial odour sources are point sources (e.g. emitted from a stack) and thus relatively straightforward to sample from, a subset of more challenging area sources exist, particularly in the wastewater, biosolids, and agriculture/livestock sectors. Two prominent methodologies exist for collecting samples from area sources, flux hoods and wind tunnels. Significant effort has led to standardisation of the design and operation of flux hoods, providing reproducible sampling results from these systems. The design and operation of wind tunnels has not yet been standardised, with a wide range of systems being available, and there is little consensus on the optimal operating conditions or sampling locations. Furthermore, as seen in several studies, due to the fundamental operating principles of the two processes, they do not produce comparable results. Further understanding of the biases introduced by the wind tunnel system and on how to best integrate the produced data into current odour assessment and modelling practices is needed.

Project Objectives

1. Evaluate existing wind tunnel designs and configurations to identify key weaknesses.
2. Identify optimal design and operating practices for wind tunnels used in odour sampling.
3. Develop a standardised wind tunnel design criteria and operation/sampling methodology.

Project Methodology

A combination of chemical and olfactory techniques will be used to acquire detailed data on the influence of key wind tunnel design and operational factors on measured odour and odorant concentrations. These techniques will also be applied to develop an understanding of biases inherent in this form of sampling, for example emphasis of certain compounds based on their volatility.

The project will involve laboratory and field-based experimentation as well as fluid dynamic modelling of a range of wind tunnel designs. Further work will investigate methods for integrating wind tunnel data into existing dispersion modeling packages used in Australia (including AUSPLUME and CALPUFF). A novel sampling and design protocol will be developed to support future sampling efforts utilizing wind tunnels.

Project Outcomes

The intended outcome of this research will be to contribute to:

- Improving the design and operation of wind tunnels used in odour sampling from area sources.
- Establish benchmarked practices for the design, construction, and operation of wind tunnels.
- Enabling the acquisition of accurate data to better support the assessment and abatement of odour emissions.

Further Information on the project may be obtained from Prof Richard Stuetz (email: r.stuetz@unsw.edu.au). Applications (including a cover letter, academic transcript and CV) should be submitted to Prof Stuetz, UNSW Water Research Centre, University of New South Wales, Sydney NSW 2052.