



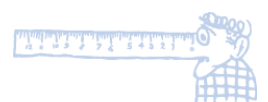
Report

Odour testing of 2 no. biofilters serving
the Phase 1 IVC and Phase 2 MBT at
FCC Wrexham

Client: FCC Environment
Ground Floor West
Northampton NN4 7RG

Report number: FCCE18A0_02
Project code: FCCE18A

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1 Introduction and scope

1.1 Introduction

FCC Environment operate a waste processing facility in Wrexham. Phase 1 of the treatment process is IVC and phase 2 is a Mechanical Biological Treatment (MBT) plant. Each phase is served by 2 No. biofilter odour control units which operate in parallel. Sampling was undertaken on the combined inlet (untreated) airflow and the combined outlet (treated) airflow of each set of biofilters.

The scope of the study was as follows:

- To determine the odour concentration, in terms of European odour units, of the combined inlet and outlet airstreams of each of the biofilter odour control units.
- To measure the airflow at the inlet and outlet sample locations of each unit and determine the odour emission rate in terms of European odour units per second.

The sampling was undertaken on 20th August 2018 and this report presents the findings of the assessment.

1.2 Structure of report

This report is structured as follows:

- Section 2 describes the approach adopted to undertake the study.
- Section 3 presents the results of the study.
- Section 4 summarises the findings of the study.

1.3 Quality Control and Assurance

Odournet's odour measurement, assessment and consultancy services are conducted to the highest possible quality criteria by highly trained and experienced specialist staff. All activities are conducted in accordance with quality management procedures that are certified to ISO9001 (Certificate No. A13725).

All sensory odour analysis and odour sampling services are undertaken using UKAS accredited procedures (UKAS Testing Laboratory No. 2430) which comply fully with the requirements of the international quality standard ISO 17025: 2005 and the European standard for olfactometry EN13725: 2003. Where required, Odournet are accredited to conduct odour sampling from stacks and ducts in accordance to ISO 17025: 2005 and EN13725: 2003 under the MCERTS scheme. Odournet is the only company in the UK to have secured UKAS accreditation for all elements of the odour measurement and analysis procedure. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

The Odournet laboratory is recognised as one of the foremost laboratories in Europe, consistently outperforming the requirements of the British Standard for Olfactometry in terms of accuracy and repeatability of analysis results.



2 Description of approach

The following approach was adopted for the study (further information regarding the sampling and analysis techniques is presented in Annex A):

1. All odour sampling was conducted using Odournet's UKAS accredited odour sampling techniques (Testing Laboratory No. 2430) that comply with the British Standard for Olfactometry BS EN 13725:2003¹.
2. Odour samples were collected in triplicate from the following locations over a period of approximately 10 minutes per sample. The inlet and outlet samples from each OCU were collected simultaneously.
 - Phase 1 IVC biofilter OCU - combined inlet airstream
 - Phase 1 IVC biofilter OCU - combined outlet airstream
 - Phase 2 MBT biofilter OCU - combined inlet airstream
 - Phase 2 MBT biofilter OCU - combined outlet airstream
3. The collected samples were transported to the Odournet UK Ltd olfactometry laboratory located in Altrincham (UKAS Testing Laboratory number 2430) and the odour concentration determined in accordance with BS EN 13725:2003.
4. Measurements of the airflow and temperature at each sample location were conducted in accordance with Odournet's UKAS accredited procedures, based on ISO 10780:1994².
5. The results of the sampling and analysis were used to calculate the odour emission rate ($\text{ou}^{\text{E}}/\text{s}$) from the biofilter.

¹ BSEN 13725:2003, Air quality - Determination of odour concentration by dynamic olfactometry

² ISO 10780: Stationary source emissions *Measurement* of velocity and volume flowrate of gas streams in ducts. Where flow measurement locations are not compliant with ISO 10780 the uncertainty of airflow measurement results cannot be quantified



3 Results of assessment

3.1 Olfactometry and airflow results

The results of the sampling undertaken on 20th August 2018 are presented in Table 1 below:

Table 1: Results of olfactometry analysis and airflow measurement

Source		Odour concentration [ou_E/m^3]				Airflow [Nm^3/s] ³	Odour emission rate [ou_E/s]
		Geomean	Sample 1	Sample 2	Sample 3		
PHASE 1 IVC BIOFILTER	Combined inlet airstream	6,320	7,211	6,168	5,676	22.1	139,672
	Combined outlet airstream	1,133	1,481	1,002	981	17.1	19,374
PHASE 2 MBT BIOFILTER	Combined inlet airstream	8,366	6,102	8,504	11,285	4.4	36,810
	Combined outlet airstream	1,540	1,496	1,791	1,364	11.5	17,710

3.2 Discussion of results

A review of the results presented in Table 1: Results of olfactometry analysis and airflow measurement prompts the following observations:

- At the time of testing on 20th August 2018 the odour concentration of the air presented to the Phase 1 biofilter was relatively low and had a geometric mean odour concentration of 6,320 ou_E/m^3 . The geometric mean odour concentration of the air emitted from the biofilter was 1,133 ou_E/m^3 . This equates to a reduction in odour concentration of approximately 82%⁴. The odour emission rate calculated at the outlet was 19,374 ou_E/s .
- The odour concentration of the air presented to the Phase 2 biofilter had a geometric mean odour concentration of 8,366 ou_E/m^3 . The geometric mean odour concentration of the air emitted from the biofilter was 1,540 ou_E/m^3 . This equates to a reduction in odour concentration of approximately 81%⁵. The odour emission rate calculated at the outlet was 17,710 ou_E/s .
- The residual odour concentration measured at the outlet of both the phase 1 and phase 2 biofilters is indicative of odour control units that are operating effectively. In Odournet's experience well designed, operated and maintained biofilters are capable of achieving significant and sustainable reduction of odour in the order of 90% and/or achieve typical outlet concentrations in the range 200 ou_E/m^3 up to 5500 ou_E/m^3 . Although the abatement efficiency does not meet the 90% level described above, it is considered unlikely for a biofilter receiving a low load to achieve such an abatement

³ Airflow rate standardised to 293K, 101.3 kPa, wet gas for odour, as outlined in BS EN 13725:2003. Flow measurement locations were non-compliant with the requirements of ISO 10780, therefore the uncertainty of the airflow measurements cannot be defined.

⁴ The odour removal efficiency has been calculated based upon the odour concentration rather than the odour emission rate. The result assumes that the airflow into and out of the biofilter is the same, and that differences in the airflow measurement results are due to the non-compliance of the measurement locations with the requirements of ISO 10780 and the associated uncertainty of the measurement technique.

⁵ The odour removal efficiency has been calculated based upon the odour concentration rather than the odour emission rate. The result assumes that the airflow into and out of the biofilter is the same, and that differences in the airflow measurement results are due to the non-compliance of the measurement locations and the associated uncertainty of the measurement technique. However it should be noted that the airflow measurement at the inlet to the phase 2 biofilter was significantly lower than at the outlet and may be indicative of a leak.



efficiency given the observation that biofilter media will have its own odour, meaning that a residual odour resulting from the media itself will always be present in treated airstreams from biofilters.

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Annex A Odour sampling and analysis techniques

A.1 Collection of odour samples from odour control plant

Collection of samples from ducts was conducted using the 'Lung' principle. A 40l Nalophan sample bag was placed in a rigid container and connected to the duct containing odorous gas using a PTFE sample line. Air was withdrawn from this container using a pump which caused a sample of the odorous air to be drawn through the line into the bag.

The temperature and velocity of the airflow at each point was also determined using suitable monitoring techniques and calibrated equipment.

The emission rate of odour was then calculated by multiplying the measured odour concentration by the volume flow rate (m^3/s) as measured in the duct.

A.2 Measurement of odour concentration using olfactometry

Odour measurement is aimed at characterising environmental odours, relevant to human beings. As no methods exist at present that simulates and predicts the responses of our sense of smell satisfactorily, the human nose is the most suitable 'sensor'. Objective methods have been developed to establish odour concentration, using human assessors. A British standard applies to odour concentration measurement:

- BS EN13725:2003, *Air quality - Determination of odour concentration by dynamic olfactometry*.

The odour concentration of a gaseous sample of odorants is determined by presenting a panel of selected and screened human subjects with that sample, in varying dilutions with neutral gas, in order to determine the dilution factor at the 50% detection threshold (D_{50}). The odour concentration of the examined sample is then expressed as multiples of one European Odour Unit per cubic meter [ou_E/m^3] at standard conditions.

