

***COMPOUND SPECIFIC MONITORING  
OF PRE AND POST TREATED PHASE  
1 COMPOST ON BEHALF OF QUAVER  
TECHNOLOGIES***

**Draft**

**For the Attention of:**  
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### *Executive Summary*

Bord na Móna Technical Services was commissioned by Mr. Ciaran Walsh to carry out compound specific monitoring of pre and post treated phase 1 compost at the Shannon Vermicomposting facility in Rathcabbin, Co. Tipperary. The purpose of this assessment was to determine the concentration of the selected parameters and to make a comparison of the results with the recorded levels associated with each type of compost.

The site was subsequently visited on 8<sup>th</sup> and 11<sup>th</sup> of April 2005 by an Environmental Consultant to carry out the monitoring survey.

Samples of gas of approximately 60 litres were collected via Teflon tubing into Nalophane<sup>®</sup> gas sampling bags by means of the "lung principle" method. Using this method, the sample bag was housed in a sealed car buoy that is evacuated using a small air pump. The volume of air removed from the car buoy was replaced by sample gas entering the bag, thus avoiding contamination of sample by pumps or meters. Analysis of the bags for Hydrogen Sulphide was carried out at the site using a real-time H<sub>2</sub>S analyser. The bags were then sub sampled using adsorption tubes for the other compounds of interest and the tubes subsequently analysed using GC-MS.

Comparison of the recorded Hydrogen Sulphide levels from the untreated and the treated on sampling day 1 indicate significantly lower levels present in the treated compost. It was not possible to quantify the other compounds of interest due to the high levels of VOC's on the sampling tubes.

Comparison of the recorded Hydrogen Sulphide levels from the untreated and the treated on sampling day 2 indicate a lower level of reduction of this compound in the treated compost. Comparison of the recorded levels of Carbon Disulphide, Di methyl Disulphide and Di Methyl sulphide recorded for the treated and untreated indicate a significant reduction in the levels of these compounds. The level of reduction is significant but should be considered an approximation due to the interference of the high level of VOC's present on the tube.

Subjective observation made on both days on the compost piles indicate that the treated compost pile appeared to have lower moisture content and to be producing less leachate on the second sampling day.

Respectively Submitted

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## 1.0 INTRODUCTION

Bord na Móna, Technical Services was commissioned by Mr. Ciaran Walsh of Quaver Technologies to carry out compound specific monitoring of the pre and post treated phase 1 compost in order to determine the concentration of the selected parameters and compare the results with recorded levels associated with each type of compost.

## 2.0 SCOPE

### 2.1 Scope of Project

Table 2.1 shows the scope of the monitoring survey:

<b>TABLE 2.1 SCOPE OF MONITORNG</b>		
<b>Parameter</b>	<b>Frequency</b>	<b>Sampling Locations</b>
Hydrogen Sulphide	<b>Sampling was carried out on 8<sup>th</sup> &amp; 11<sup>th</sup> April 2005</b>	<b>Pre and Post treatment</b>
Di methyl sulphide		
Di- methyl disulphide		
Carbon disulphide		

These compounds were chosen in conjunction with Dr. Abdul Al-Amidi.

### 3.0 METHODOLOGY

A large section of clean, new polyethylene was cut and placed over a significant area of each compost pile. Each section was greater than 3m<sup>2</sup>. The edges of each section were buried into the compost to ensure that a wind proof seal was formed and therefore the odour emitted from the piles was not diluted by ambient air. The headspace within the enclosed section was allowed to stabilise for at least 20minutes. Following this period a small cut was made in the cover and the sampling line inserted.

Samples of gas of approximately 60 litres were collected via Teflon tubing into Nalophane<sup>®</sup> gas sampling bags by means of the "lung principle" method. Using this method, the sample bag is housed in a sealed car buoy that is evacuated using a small air pump. The volume of air removed from the car buoy is replaced by sample gas entering the bag, thus avoiding contamination of sample by pumps or meters. The gas will then be sub sampled over adsorption tubes for the compounds of interest.

#### 3.1 Hydrogen Sulphide

H<sub>2</sub>S monitoring was carried out using a Jerome 631-X H<sub>2</sub>S analyser. This instrument utilises a patented gold film sensor to make accurate determinations of Hydrogen Sulphide levels well below the conventional odour nuisance threshold of 8-12 ppb. When sampling, an internal pump draws air into the instrument and any hydrogen sulphide present is absorbed onto the gold leaf sensor. The sensor is selective to hydrogen sulphide which causes a change in electrical resistance properties directly proportional to the gas concentration. The gold film sensors' selectivity to H<sub>2</sub>S eliminates interference from SO<sub>2</sub>, CO<sub>2</sub>, CO and water vapour. Sensor calibration can be verified in the field using the Jerome H<sub>2</sub>S functional test kit. The analysis range of the Jerome 631-X is from 0.001ppm to 50 ppm (parts per million). The limit of detection is 0.003ppm.

#### 3.2 Di-methyl Sulphide, Di-methyl disulphide, Carbon disulphide

A measured volume of air was drawn through diffusion tubes at a flow rate of approximately 200ml/min. by means of an intrinsically safe SKC pump. Sampling was carried out over a 45 minute period. The contents of the tube are desorbed and then analysed using gas Chromatography- Mass Spectrometry (GC-MS). The results are expressed in mg/Nm<sup>3</sup>. Analysis of the tubes was carried out in a UKAS approved laboratory.

**4.0 RESULTS**

**TABLE 4.1: HYDROGEN SULPHIDE SAMPLING RESULTS**

Locations	Parameters	Day 1	Average	Percentage Reduction %	Day 2	Average	Percentage Reduction %
		Concentration (ppm)			Concentration (ppm)		
Pre Treatment	Hydrogen Sulphide	0.95	1.00	-	0.52	0.560	-
		0.96			0.55		
		1.00			0.57		
		1.00			0.58		
		1.10			0.57		
		0.99			0.57		
		0.10			0.38		
Post Treatment	Hydrogen Sulphide	0.11	0.113	88.5	0.39	0.395	29.5
		0.10			0.40		
		0.12			0.40		
		0.13			0.40		
		0.12			0.40		

**TABLE 4.2: SULPHUR COMPOUNDS SAMPLING RESULTS**

Locations	Parameters	Day 1 Concentration (µg/m <sup>3</sup> )	Percentage Reduction %	Day 2 Concentration (µg/m <sup>3</sup> )	Percentage Reduction %
Pre Treatment	Di methyl sulphide	See Note 1	See Note 1	191.8	-
	Di methyl disulphide	See Note 1		197.7	-
	Carbon disulphide	See Note 1		230.4	-
Post Treatment	Di methyl sulphide	See Note 1	See Note 1	<3.0	98
	Di methyl disulphide	See Note 1		<3.0	98
	Carbon disulphide	See Note 1		20.8	91

Note 1: Analysis of these tubes indicated very significant levels of VOC's (see Table 4.3). The presence of these compounds in such high levels would mask the lower concentrations of the sulphur compounds of interest. Therefore it was not possible to identify and quantify the sulphur compounds of interest.

**TABLE 4.3: TOP 10 VOCs SAMPLING RESULTS**

Locations	Parameters	Day 1	Percentage Reduction %	Day 2	Percentage Reduction %
		Total Concentration Note 1 (µg/m <sup>3</sup> )		Total Concentration Note 1 (µg/m <sup>3</sup> )	
Pre Treatment	Top 10 VOC's	13,822.9	-	10,035.9	-
		6928.0	49.9	9,002.7	10.3

Note 1 Total concentration refers to the combined concentration of the top 10 identified VOC's, it may not reflect the overall amount of VOC's on the tube.

## 5.0 COMMENT

Sampling was carried out at the Shannon vermin-composting site in Rathcabbin, Co. Tipperary on the 8<sup>th</sup> and 11<sup>th</sup> of April 2005 on behalf of Quaver Technologies. A number of specific organosulphur compounds were targeted for sampling and analysis from two compost piles (treated and untreated). The results of the sampling programme are outlined in Tables 4.1 to 4.3.

Results from the sampling programme on day 1 indicated that the treated compost produced significantly lower levels of hydrogen sulphide. Due to the high levels of VOC's being emitted from the piles it was not possible to identify or quantify the other compounds of interest, namely, carbon disulphide, di methyl sulphide and di methyl di sulphide.

Subjective observations of the compost piles on the day of sampling would indicate that both piles were actively composting due to the high temperature of the compost. Also both piles would be considered to have similar moisture content and it was also observed that leachate was actively being produced by both piles.

Results from the second day of sampling indicate a less significant reduction in hydrogen sulphide concentrations in the treated compost. In this case it was possible to determine the levels of the other compounds of interest and they displayed a significant reduction in levels between the untreated and treated. The percentage reduction indicated should be taken to be an approximation due to the high levels of VOC's but would nevertheless be considered to be significant.

Subjective observations of the compost piles on the second day of sampling would indicate that both piles were actively composting due to the high temperature of the compost. It is noted that the temperature of the second (treated) pile would have appeared to be lower (next to the surface). It was observed that the moisture content of the treated pile would have been lower and it was also observed that the amount of leachate being produced from the treated pile was significantly lower than the untreated pile.