

# MEMORANDUM

Date: 4 January 2007

Ref No:

To: Acting Manager Yarra Region - Quentin Cooke

From: Paul Torre

Subject: **CHEMICAL ANALYSIS RESULTS OF VOLATILE SPECIES FROM AIR SAMPLES TAKEN AT ANL COMPOSTING**

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Two air samples, collected over the leachate pond (sample No.03832/1) and Windrow 1 at ANL Composting (sample No.03832/2) on the 8/11/06 were submitted for laboratory chemical analysis for specific air toxic<sup>1</sup> VOC compounds and for the identification of Volatile Organic Compounds (VOCs). The samples were analysed by gas chromatography with mass spectrometric detection (GC/MSD). Sample components were identified by comparison with reference gas standards and computer matching of MSD mass spectra with a reference library of spectra. Tentative identification using reference library of spectra was conducted where reference gas standards were not available for confirmation of identification. The actual concentrations of the tentative identified compounds could not be determined due to the absence of a reference gas standard.

The samples were also analysed for specific air toxic VOC compounds by USEPA Method TO-15<sup>2</sup>. The concentrations of the air toxic VOC compounds identified and quantified using reference standards are listed in Table 1.

**Table 1. Concentration of Air Toxics VOCs**

| Sample No: 03832/1 |             | Sample No: 03832/2 |             |
|--------------------|-------------|--------------------|-------------|
| Compound           | Conc (ppbv) | Compound           | Conc (ppbv) |
| Benzene            | 1           | Benzene            | 2           |
| Toluene            | 10          | Toluene*           | 13          |
| xylene             | 6           | xylene             | 9           |

ppb = part per billion (volume/volume)

These air toxic compounds make up less than 1% of the total VOC concentration measured. The concentrations measured are low and typical of the levels measured in the suburbs of Melbourne<sup>3</sup> and are generally derived from motor vehicle emissions.

<sup>1</sup> Air toxic VOC compounds specified in the National Environment Protection (Air Toxics) Measure, Nation Environment Protection Council, December 2004

<sup>2</sup> Compendium Method TO-15: Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS), Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency January 1999

<sup>3</sup> EPA Publications, 948-Air Monitoring at Nunawading September 2003 to February 2004, 974- Air Monitoring alongside the Westgate Freeway, 1022-Air Monitoring In Corio 2002-2005

Approximately forty and sixty VOCs were tentatively identified in sample 03832/1 and 03832/2 respectively (see attached Table 2). The samples mainly consisted of similar plant derived VOCs and VOCs generated from typical composting activities<sup>4</sup>. The VOCs are listed in compound class and their likely origin and in order of their relative concentration in that class.

The pond sample, 03832/1 contained a higher proportion of plant composting alcohols (methanol, ethanol), ketones (acetone). Compared with the higher proportions of plant derived terpenes (terpinene, eucalyptol give tree aroma, limonene lemon aroma) compounds, alcohols (methanol, ethanol) and esters (methyl and ethyl esters, give fruity aromas) from the freshly turned windrows of composting matter in sample 03832/2.

One significant difference between the two samples is the higher number and proportions of sulfur containing compounds in sample 03832/1 compared with sample 03832/2.

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<sup>4</sup> (M)VOC and Composting Facilities. Part 1: (M)VOC Emissions from Municipal Biowaste and Plant Refuse, Mueller, Thomas; Thissen, Ralf; Braun, Sylvia; Dott, Wolfgang; Fischer, Guido; ESPR-Environ Sci & Pollut Res 11(2) 2004.

**Table 2: Tentatively identified VOCs**

| Sample No: 03832/1   |
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| <b>Alcohols (plant composting)</b>   |
| Methanol<br>Ethanol<br>Isopropanol<br>Propanol<br>isobutanol<br>1-butanol<br>2-butanol<br>cymene<br>isopentanol          |
| <b>Ketones (plant composting)</b>  |
| Acetone<br>2-butanone<br>2-pentanone   |
| <b>Aldehydes &amp; oxygenates (plant derived)</b>  |
| 2-methyl-1,3-dioxolane<br>2-butenal<br>Dichloromethane<br>Methyl Acetate<br>hexanal<br>3-methylbutanal<br>pentanal       |
| <b>Sulfur Containing (plant composting)</b>  |
| Methanethiol<br>Dimethyl sulfide<br>dimethyl disulfide<br>dimethyl trisulfide<br>Carbon disulfide                        |
| <b>Terpenes (plant derived)</b>  |
| Eucalyptol<br>alpha-pinene<br>limonene<br>delta-3-carene<br>beta-pinene<br>gamma-terpinene<br>camphene<br>sabinene       |
| <b>Hydrocarbons (vehicle-air/fuel)</b>   |
| toluene<br>trimethylbenzene<br>1-ethyl,3-methyl benzene<br>pentene<br>undecane<br>2,2,4,6,6-pentamethylheptane<br>decane |

| Sample No: 03832/2   |
|--|
| <b>Terpenes (plant derived)</b>  |
| terpinene<br>Eucalyptol<br>limonene<br>cymene<br>delta-3-carene<br>beta-pinene<br>gamma-terpinene<br>camphene<br>sabinene<br>carene<br>camphene<br>alpha-pinene<br>thujone<br>alpha-terpinene<br>phellandrine<br>alpha-thujene<br>L-fenchone<br>camphor  |
| <b>Alcohols (plant composting)</b>   |
| Methanol<br>Ethanol<br>propanol<br>2-butanol<br>Isopropanol<br>isoamyl alcohol<br>isobutanol<br>2-methyl butanol<br>2-pentanol   |
| <b>Hydrocarbons (vehicle-air/fuel)</b>   |
| nonane<br>styrene<br>toluene<br>undecane<br>trimethylbenzene<br>1-ethyl,3-methyl benzene   |
| <b>Ketones (plant composting)</b>  |
| Acetone<br>2-butanone<br>2-pentanone<br>3-methyl-2-butanone<br>2,4-dimethylpentanone<br>butanedione  |
| <b>Esters (plant derived)</b>  |
| Methyl Acetate<br>ethyl acetate<br>methyl butanoate<br>ethyl butyrate<br>Methyl formate<br>methyl isopentanoate<br>propyl acetate<br>isoamyl acetate<br>methyl hexanoate<br>ethyl butanoate<br>propyl butanoate<br>methyl pentanoate<br>ethyl-propanoate<br>ethyl isopentanoate<br>butyl acetate<br>isobutyl acetate |
| <b>Aldehydes (plant derived)</b>   |
| 3-methylbutanal<br>2-methylbutanal<br>2-methyl-1,3-dioxolane<br>butenal<br>hexanal<br>2-butenal<br>butanal   |
| <b>Sulfur Containing (plant composting)</b>  |
| dimethyl disulfide<br>Dimethyl sulfide<br>Carbon disulfide   |