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Reference: 48557

24 May 2017

Upper Highway Air NPO
19 La Vigna
Plantations Estate
Hillcrest

Attention: Charmane Nel

RE: AMBIENT AIR QUALITY TESTING NEAR ENVIROSERV SHONGWENI LANDFILL

Members of the WSP Environmental Air Quality team conducted air quality testing adjacent to the western fenceline of the Enviroserv Shongweni Landfill (**Figure 1**) during the early afternoon of the 8th of May 2017. The wind was blowing in a north-easterly direction during sampling. The sun was shining and there was approximately 20% cloud cover. While the team detected a landfill smell during the sampling session, it was agreed that this was not at the high intensity experienced on some previous visits to the fenceline. My personal description of the smell was 'typical rotten egg (hydrogen sulphide) landfill smell combined with petroleum-type hydrocarbons'.

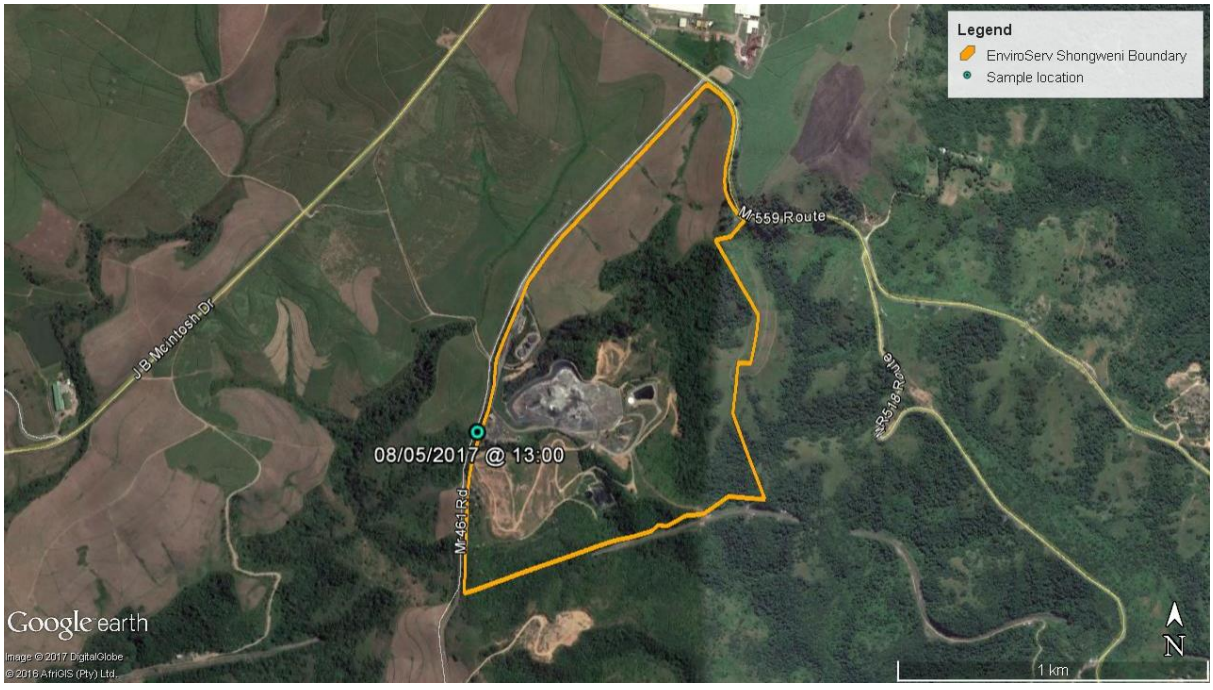

Figure 1: Sampling Location

Three cubic decimetres (3 dm^3) of air was pumped through two Markes International sorbent tubes (G0129825 and G0129891). A sample blank (G0129826) was also collected. This methodology is in accordance with the United States Environmental Protection Agency (US EPA) TO-14a. The sample blank (G0129826) was collected first followed by the two 15-minute samples at 200 ml/minute – G0129825 (12h50 - 13h05) and then G0129891 (13h10 - 13h25). Pump flow rates were controlled internally but were checked against a Bios Defender standard prior to use. The three tubes were transported directly from the site to Skyside (Pty) Ltd in Riverhorse Valley,

Durban, from which they were transferred for analysis at X-Lab Earth Science (Pty) Ltd in Randburg (SANAS Accredited Laboratory number T0775). The samples were received by X-Lab in Randburg on the 11th of May 2017. The samples were screened for a full spectrum of volatile organic compounds. Analysis commenced on the 15th of May 2017 at 10h55 and was completed on the 15th of May 2016 at 15h16. Results were signed off by Martin Olivier, Operations Manager at X-Lab. The gas chromatography-mass spectrometry (GCMS) component of this analysis falls under X-Lab's current accreditation. While X-Lab conforms to ISO/IEC 17025 standards, the thermal desorption component of these analyses currently falls outside of the scope of X-Lab's accreditation. I am not aware of another local laboratory that is accredited for this technique.

Results are presented in **Table 1** and **Table 2** below, accounting for the measurements on the sample blank (G0129826). The only volatile organic compound with a National Ambient Air Quality Standard (NAAQS) is benzene with an annual NAAQS of 5 µg/m^3 (0.005 µg/dm^3) or 1.6 ppbv (0.0016 ppmv). For assessment of health impacts, volatile organic compounds generally are compared with long-term (annual) guidelines. These are not appropriate here due to our short (15-minute) sampling period. The Texas Commission on Environmental Quality's (TCEQ) provides *Effects Screening Levels* (ESLs) for short-term (generally hourly) exposures. These ESLs were developed from data on health effects, vegetation or corrosion effects and odour nuisance potential. If the predicted ambient concentrations do not exceed these levels, no adverse environmental or health effects are expected. Benzene concentrations as measured by G0129891 exceeded the TCEQ short-term ESL (170 µg/m^3). The concentrations of m/p xylenes as measured by G0129825 and G0129891 also exceeded the TCEQ short-term ESL (2200 µg/m^3). The concentrations of styrene as measured by G0129825 and G0129891 exceeded the TCEQ short-term ESL (110 µg/m^3) as well as World Health Organisation (WHO)[1] guidelines of 260 µg/m^3 (weekly average for health impact) and 70 µg/m^3 (30-minute average for odour impact). These results indicate that further investigation of the landfill's impact on ambient air quality and human health is warranted.

Table 1: Field Measurement Results (µg/m^3, 15-minute averaging period)

	Concentrations Measured in Ambient Air (µg/m^3)		TCEQ ESL (µg/m^3)
Compound	**G0129825**	**G0129891**	
Benzene	<RL*	3667	170
Ethylbenzene	1010	1210	26000
m/p-xylene	4003	4670	2200
o-xylene	1710	2177	2200
Styrene	1377	1343	110
Tetrachloroethene	367	300	2000
Toluene	1700	2033	4500

*Below reporting limit (~3500 µg/m^3)

Table 2: Field Measurements (ppbv, 15-minute averaging period)

	Concentrations Measured in Ambient Air (ppbv)		Odour Threshold[2] (ppbv)
Compound	**G0129825**	**G0129891**	
Benzene	<RL*	1147.73	4680
Ethylbenzene	232.59	278.65	NA
m/p-xylene	922.01	1075.56	470
o-xylene	393.83	501.31	NA
Styrene	323.18	315.36	100**
Tetrachloroethene	54.06	44.23	4680
Toluene	451.10	539.56	2140

*Below reporting limit (~1000 ppbv)
**Inhibited

[1] WHO (World Health Organisation) (2000): **Air Quality Guidelines for Europe**, Copenhagen, 273 pp.

[2] Leonardos, G.; Kendall, D. & Barnard, N. (1969). *Odor Threshold Determinations of 53 Odorant Chemicals* in **Journal of the Air Pollution Control Association**, 19:2, 91-95, DOI: 10.1080/00022470.1969.10466465

Measured concentrations of the volatile organic compounds were compared with the odour thresholds published in Leonardos *et al.* (1969)[3] with the understanding that there is often a wide range of published odour thresholds for these compounds. The concentrations of m/p-xylenes measured by G0129825 and G0129891 exceeded the odour threshold (470 ppmv). The concentrations of styrene measured by G0129825 and G0129891 also exceeded the respective odour threshold (100 ppmv), suggesting odour nuisance by volatile organic compounds beyond the boundary of the site. Further investigation of odour impacts by volatiles from the site clearly is warranted.

Some discrepancies between the WSP results and those of the 15 hydrocarbon samples collected by Infotox on the Enviroserv site (Annexure 3 to Infotox Report dated 10 April 2017**)** are noted here. The maximum benzene concentration measured onsite (890 µg/m^3) by Infotox was at the brine tank. This concentration falls below our fenceline measurement G0129891 (3667 µg/m^3). The maximum styrene concentration measured onsite (414 µg/m^3) at Sample 15 (a landfill gas canister) fall below our measurements G0129825 (1377 µg/m^3) and G0129891 (1343 µg/m^3). The maximum concentration of tetrachloroethene measured onsite (125 µg/m^3) at Sample 26 (another landfill gas canister) falls below our measurements G0129825 (367 µg/m^3) and G0129891 (300 µg/m^3).

We are confident that the source of the volatile organic compounds we measured was the Enviroserv landfill site because the intensity of the hydrocarbon odour increased as we moved closer to the Enviroserv fenceline. One does not expect offsite measurements to be higher than measurements at the source, as is the case here. It appears that further onsite measurements are required since the current data collected by Infotox may be an underestimate of the real impact of the site. We have greater confidence in the volatile organic compound measurements at the Enviroserv landfill site by re-energise Africa in partnership with Siloxa Engineering AG (report dated 27 February 2017) as Annexure S of the Final Envitech Report (dated 14 March 2017). Should the Infotox concentrations be underestimates of real impact, this would in turn bring into question the atmospheric dispersion modelling results produced by Airshed.

We do not view our fenceline samples presented here indicative of peak ambient pollutant concentrations associated with the landfill emissions. Odour complaints tend to peak during low-pressure events, particularly during rainy or misty conditions. The weather was clear during our sampling. Furthermore, the higher turbulence associated with early afternoon sunshine is likely to promote vertical dispersion of pollutants, lowering ground-level concentrations relative to stable overnight conditions. The concentrations we present here are the most conservative of our recent monitoring campaigns. We expect that future testing will confirm significantly higher ambient concentrations of volatile organic compounds at the fenceline, particularly under pre-frontal conditions and/or overnight.

Yours faithfully,

Dr Lisa Frost Ramsay
Air Quality Specialist

[3] Leonardos, G.; Kendall, D. & Barnard, N. (1969). *Odor Threshold Determinations of 53 Odorant Chemicals* in **Journal of the Air Pollution Control Association**, 19:2, 91-95, DOI: 10.1080/00022470.1969.10466465