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July 05, 2017

CONFIDENTIAL

Upper Highway Air NPO
19 La Vigna
Plantations Estate
Hillcrest 3610

Attention: Charmane Nel

Subject: Subject: EnviroServ letter of 31 October 2016 - Investigation of odour generation at Shongweni landfill and evaluation of possible mitigation measures.

The letter from EnviroServ to the Department of Environmental Affairs authored by Dr JL Schoonraad provides a summary of prevailing geochemical and biological process active within the landfill to explain the generation of noxious odours and to propose possible mitigatory reponses to address the issue. The comments of our environmental expert, Dr Jon McStay are as follows.

It is common cause that there was a significant increase in odour complaints registered at Shongweni landfill site since April 2016. The landfill is a relatively large site and has been operational since 1992. The odour issue is considered the worst in the surrounding area for 24 years and it is considered likely to be linked to causative mechanisms in the operational life of the landfill immediately prior to 2016.

The landfill as a whole and leachate are identified as significant sources of odorous gas in the form of hydrogen sulphide (H_2S) and also methanethiol (CH_3SH), commonly known as methyl mercaptan, which is a typical reaction product in landfill leachate and has a 1.9ppb odour threshold.

All potentially soluble sulphates in a landfill can be reduced by bacterial action. A number of key conditions have to be met.

- The presence of liquid water
- The presence of organic material to supply carbon as a food source for bacterial growth
- The presence of sulphate containing wastes
- The absence of air
- Presence of sulphate reducing bacteria
- pH conditions between 4 and 9
- Optimum temperature

Shongweni landfill is in a high rainfall area and generates leachate and is old enough to have water saturated wastes that are undergoing anaerobic decomposition. There is co-disposal of putrescible organic wastes with solid industrial wastes. The question is thus whether significant volumes of sulphate containing wastes have been disposed of and whether these are historic or an on-going source.

The EnviroServ letter makes much comment regarding the pH conditions in the landfill in Figures 3, 4 and 5.

The measured landfill leachate pH from October 2012 to August 2016 ranges from 7.7 to 8.4 with an arithmetic mean of 7.98. The only measurement that falls significantly outside the standard deviation of the mean is from July 2015 when pH reaches its alkaline peak of 8.4.

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There is no evidence that a landfill pH of over 9 was ever achieved for the landfill or whether this was indeed ever intended.

It should be noted that the waste treatment methodology of using lime or similar reagents to increase pH was undertaken predominantly to increase the allowable monthly loading of heavy metals permitted for disposal under a regulatory process known as 'delisting', by virtue of reducing the potentially leachable components in the waste stream. It was not undertaken as a means of controlling the formation of odorous compounds in the landfill.

There is therefore no major change in pH that coincides with the implementation of new waste regulations in Valley 2 other than the probable disposal of a large volume of alkaline waste between December 2014 and July 2015. Alternatively, a significant volume of historically disposed alkaline waste became saturated around this time and contributed to a short-lived increase in pH. From the subsequent rise in hydrogen sulphide the waste stream mostly likely to cause an increase in pH would be an industrial source of waste gypsum (commonly in the pH range of 10 to 12).

EnviroServ consider that sulphates from boiler ash are a potential source. These compounds are generally of low solubility and have been disposed of and blended with other waste for many years without obvious impacts.

EnviroServ propose that by gradually increasing the pH of the leachate by the addition of lime treated wastes the problem will eventually resolve itself and the generation of hydrogen sulphide will reduce over time. Figure 5 however indicates that the only means of significantly reducing the activity of sulphate reducing bacteria is to drive the pH to highly acidic conditions of pH <4. At pH 9 sulphate reducing bacteria are reduced but still active.

From the limited amount of data and landfill records available to us at this time, it is our professional opinion that the odour problems at the landfill are most likely to arise from a build-up of leachate in the landfill cells due to inadequate leachate removal and treatment together with the saturation and bacterial breakdown of a significant volume of sulphate containing waste within the landfill. The triggering events appear to have commenced in early 2015 with odorous gases being generated in significant concentrations in early 2016.

Given the nature of waste acceptance and leachate management practices the events are considered to be foreseeable and manageable to experienced landfill practitioners.

Yours sincerely,

Dr Jon McStay
Director