

"UHA<sub>10</sub>"

## RESPONSE TO FIRST RESPONDENT'S ANSWERING AFFIDAVIT, 24 APRIL 2017

38. The incumbent treatment regime applied by EnviroServ from March 2017 is as follows:

-limiting sulphate containing waste to <1.5

-continue the acceptance of metal containing waste

-stop acceptance of metallic aluminum containing waste

'Additional treatment alternatives to increase the site's pH including treating all incoming waste to raise the internal pH of the waste body to the pH of the waste body to pH that prevailed under the Minimum Requirements. In addition the disposal of highly alkaline layers will act as buffers and scrubbing agents for the acidic H<sub>2</sub>S generated by the SRB'.

'Additional lime dosing in all treatment trenches in order to raise the pH of the overall waste body....'

The strategy is to re-introduce the far more conservative pH approach use under the previous management system by treating all wastes to a pH 9 to suppress SRB activity and by raising pH of the site to its historic pH >8.5 when no odour issues were experienced.'

It is understood the calculated gypsum load in Valley 2 (Envitech Report) is estimated to be 1.6%. Does the proposed limitation on sulphate containing waste apply to future wastes or does it consider existing waste loading? Does it imply total sulphate concentration or soluble sulphates? In its present form this remedial measure is entirely vague. Co-disposal of waste with high concentrations of soluble sulphates with wet wastes and putrescible waste with a high organic content is the principal cause of the odour problem. Any additional soluble sulphate is thus creating a future problem for this landfill.

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.

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' under the 'Minimum Requirements', 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.

Treating of all waste streams with lime is considered unnecessary and ineffective as the lime has to be actively mixed into the moist waste at depths within the landfill so that it can achieve some degree of mixing in order to have any influence on the pH of leachate. Long term (post closure) stabilisation of the leachate may eventually be achieved using this method but it will have little immediate impact on the generation of H<sub>2</sub>S in the bulk of the landfill itself. This measure is best described as being cosmetic in order to continue with active waste disposal and cannot be regarded as an intentional remediation measure. It should be noted that remedial pH controls can be undertaken independently and in-situ within the waste pile without any form of on-going waste disposal. EnviroServ have not proposed any in-situ remediation measures within the waste body to increase pH and therefore cannot view this strategy as being critical in reducing H<sub>2</sub>S within the landfill itself.

To propose that continued waste disposal is an essential remedial measure in order to solve the odour problems is clearly absurd.

No mass balance calculations are presented to estimate the mass of lime that would be needed to ameliorate the pH condition, but it is considered to be a very large volume of reagent. In such a large body of historic waste it is more likely that the pH will remain buffered within its historic range of pH values until the source of soluble sulphates has been removed and the landfill can finally evolve to a methanogenic condition.

There is 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). The leachate pH then rapidly decreased to 7.1 and this suggested the existence of an evolving acid producer. This is most likely the weak acid H<sub>2</sub>S and represents the commencement of H<sub>2</sub>S under the influence sulphate reducing bacteria.

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.

*78. 'The NPC has misconstrued the Phoenix Engineering Report. Escalated sampling and analytical frequency of the pH of the leachate would have remedied the problem. It would, however, have facilitated an earlier understanding of the circumstances that continue to impact the Shongweni site.'*

Despite the limited nature of the leachate sampling and analysis it was clearly apparent by mid 2015 that there were significant chemical trends emerging in the leachate data that should have triggered further investigation and corrective actions. This can only be considered as oversight or negligence on the part of waste operator.

*79. 'There is no rational connection between NPC's incorrect analysis of the Phoenix Engineering Report and the assertion that EnviroServ 'clearly knew what it had done and disposed of inappropriately into the SLS'. The NPC is invited to point at a single waste stream that has been accepted at the Shongweni site in contravention of either the WMP or the prevailing legislation.'*

It is noted on Page 7 of the **EnviroServ letter of 31 October 2016**, that Dr Schoonraad states

*'A review of all waste streams received at Shongweni in 2014 as well as Sep-Dec 2015 did not flag any significant waste loads received at the site that could be immediate sources of odour.'*

The Envitech Report, however estimates that the Valley 2 waste contains 15.8% of sulphur containing waste, 1.6% of gypsum containing waste and 0.9% of sulphate containing waste. It is therefore inconceivable that Dr Schoonraad was not aware of the history of the waste streams at Valley 2 and the existence of large volumes of potentially reactive sulphurous compounds that would be eventually subject to the action of sulphate reducing bacteria once the waste became wet. As Dr Schoonraad demonstrates a thorough understanding of the generation of H<sub>2</sub>S by SRB in the landfill context in his letter, it is puzzling why EnviroServ were so slow in addressing the obvious odour problem emerging at Shongweni, as their technical staff clearly understood the potential sources and reactions taking place within the landfill.

Envitech have described Shongweni Valley 2 as an example of an Extreme Temperature Landfill (ETLF). They have attributed this to adverse exothermic reactions in the landfill involving metal containing wastes.

*102. 'Metallic Aluminium containing wastes are not accepted at the Shongweni site'*

Metallic aluminium undergoes rapid oxidation under ambient conditions, which is so strongly exothermic that it can be potentially combustible, so it is considered highly unlikely that this reaction is taking place within the

landfill. The most commonly occurring reactions that could be heat producing involve the hydration of calcium oxide in dry ash wastes and dry lime. The reactions would not normally be expected to raise temperatures within a landfill by more than a few degrees, but if large quantities of waste were to become rapidly saturated then the effect could be more pronounced.

*123' .....The reality is that the p H change brought about by the Waste Regulations in 2013 reverted the waste to a predominantly acetogenic state. This together with the associated proliferation of SRB, is primarily the cause of the malodour.*

It noted from the Phoenix Report that the p H from 2013 to mid 2015 increases, and thus the impact of the new waste regulations had no causative role in the generation of odorous compounds.