



Biffa Waste Services Ltd

ATTLEBRIDGE LANDFILL SITE

Permit Number: EPR/BV4495IX

Variation Number: EPR/BV4495IX/V004

ENVIRONMENTAL MONITORING ANNUAL REVIEW 2018

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1.0 Introduction

Attlebridge Landfill Site is located at National Grid Reference TG 145 162, approximately 1Km southeast of the village of Attlebridge, Norfolk. In total the site covers some 26ha, of which approximately 11 ha is within the proposed installation boundary of Phase III (see Appendix A).

The landfill lies on flat ground above the valley of the river Wensum which flows towards the southeast some 600m to the southwest. The site is surrounded by woodland and itself surrounds three sides of a farm and an associated property known as Keepers Cottage at its northern boundary. Adjacent to the south eastern boundary lies a strip of land used by the mid-Norfolk Shooting School.

Landfilling within Attlebridge landfill site has taken place in Phase I, II and IV under WML No NFK/LS/065/4 and Phase III under WML 71190. WML NFK/LS/065/4 is now closed. A PPC permit was issued for Phase III only and supersedes WML 71190, permit number BV4495 issued on 30/03/2009. A variation notice for BV4495 was issued on 17/02/2010 to include asbestos.

Phase I operated for about 20 years until September 1996 and was designed on the basis of natural attenuation (dilute and disperse). Phase II (the western extension) comprises an area to the west of Phase I which received waste following the closure of Phase I. Landfilling transferred to Phase III in April 2002. The Mid Norfolk Shooting School was originally partly located within the area of Phase III development and consequently was relocated during 1999 prior to landfilling operations. The site ceased accepting waste during March 2012. In August and September 2012, the remaining uncapped area was capped.

The surface water management scheme approved by the Agency for the whole site was constructed in 1999. This comprised the use of lined and unlined drainage ditches directing run-off to a series of soakaways. Each soakaway comprises a pre-settlement pond and an infiltration basin. An additional Soakaway F was constructed in the second half of the year which soaks away to the North Eastern perimeter of the site. A new surface water point, namely Soakaway G, which is located in front of the Leachate Treatment Plant, was included within the latest permit variation (EPR/BV4495IX/V004) and has been monitored since its installation.

All monitoring carried out on site is compliant with internal Quality Procedures and as specified by the site's permit.

Biffa Waste Services are required to provide on an annual basis a report of the environmental performance of Attlebridge Landfill Site. This includes analysis and review of the monitoring results recorded for the installation, with an interpretation of the trend of the results against background and trigger levels as per EPR Permit Section 4.2.2. The review period for this report is from 1st of January 2017 to 31st of December 2017.

2.0 Review of Environmental Monitoring Data

2.1 Landfill Gas Monitoring

Landfill Gas is monitored on a monthly basis at the site. Using a fully calibrated Infrared Gas Analyser, the atmospheric pressure and concentration of Methane (CH₄), Carbon Dioxide (CO₂), and Oxygen (O₂) is recorded in perimeter boreholes.

The trigger levels for the gas perimeter monitoring boreholes are:

- CH₄ = 1.0% Vol
- CO₂ = borehole specific % Vol

The results obtained from gas monitoring during this annum are shown in appendix B, summarised in Table 1 and are graphically displayed in Figures 1 - 3. All boreholes were monitored this annum. The maximum value for CH₄ in 2018 was 0.1% in SS01. The maximum values of CO₂ recorded during 2017 was 2.2% in SS4A and SS4B.

Figures 1 – 3 display the CO₂ levels in the 2017 to 2018 period. CH₄ remained below 0.1% for the duration of 2018, as such it has not been included in the graphs.

As per the agreement with the Environment Agency, in October 2015 Biffa submitted a risk-based review of Carbon Dioxide levels and assessed trigger levels for Phases I, II and IV based on the relevant Industry Code of Practice (ICoP) and Closing Landfill Project (CLP). The document seeks to remove CO₂ compliance limits and it follows a series of other submissions discussing the known natural elevation of CO₂ in this area due to the underlying geology.

Figure 1 shows that CO₂ levels in boreholes SS01, SS1A, SS02 and SS2A have been very low and compliant with trigger limits during 2018. Through 2018 levels in all four boreholes has been around 0.1%. The spikes seen in 2017 have not occurred in 2018. There was a small increase in CO₂ levels in June 2018 when the levels peaked to 1.2% in SS01 and 0.5% in SS1A, however these were under the trigger limit for the permit and reduced to 0.1% in the next month's monitoring.

Figure 2 shows the levels of CO₂ in SS03, SS3A, SS3B, SS04, SS4A and SS4B. The figure shows that through 2018 the boreholes have maintained a stable low trend from June 2017 onwards, with levels usually around 0.1%. There have been periodic spikes in readings through the year in March, June, July and December where readings increased in some boreholes, however the increases were small and reduced to 0.1% in the next month. Throughout 2018 these boreholes stayed compliant with the permit limits.

Figure 3 show the CO₂ levels in SS05, SS5A, SS06, SS6A and SS07. As can be seen from the figure, these boreholes have followed similar trends to other boreholes on site. From June 2017 onwards we have

recorded frequent low levels of CO₂ around 0.1%. There have been some spike in readings in January, March and June 2018, however similar to other boreholes these have reduced back to 0.1% the next month. The boreholes remained complaint during 2018.

2.2 Groundwater Monitoring

Groundwater level data is recorded quarterly at the 7 groundwater boreholes located around the perimeter of the Permit area of the site. This data can be found in Appendix C, is summarised in Table 2 and Figure 4 which show that groundwater levels ranged between around 10.29mAOD to 16.55 mAOD during 2017. Figure 4 shows that the groundwater levels have maintained their stability from 2016 into 2017 with very little changes being recorded.

Perimeter groundwater boreholes are sampled quarterly and annually. The groundwater boreholes are purged where possible prior to sampling to ensure formation water is taken for analysis. All samples are analysed by an accredited laboratory. Results for this annum are shown in Appendix D and a review of the groundwater quality for Ammoniacal Nitrogen, pH, Chloride, and Nickel are presented in Figures 5 - 8.

Figure 5 shows ammoniacal nitrogen in the groundwater boreholes. During 2018 levels of ammoniacal nitrogen in BHs 23, 24, 25, 26, 27 and 28 are low throughout the year, levels are usually below or just above the limit of detection. The levels in these boreholes remained below the permit limit of 1.5mg/l for the duration of 2018. BH22 recorded levels below the limit of detection from 2017 until April 2018, then a large increase with a result of 8.27mg/l. The levels in BH22 then gradually began to decline through the year to 1.61mg/l in October. We expect the levels in this borehole to become complaint again in 2019.

Figure 6 demonstrates that pH values exhibited natural variation during 2017 and 2018. The levels remained stabled from 2017 into 2018. BH28 follows its own trend separate from the other boreholes, as it continued to climb when other boreholes declined after April 2018.

Figure 7 demonstrates that the levels of chloride are lower in 2018 than in 2017 in all boreholes except BHs 22, 27 and 28. BH22 follows a similar trend to the levels of ammoniacal nitrogen found in it, with a sharp rise from January to April 2018, then a gradual decreases towards October with results similar to other boreholes on site. BH28 has shown gradual increases from 2017 into 2018, however October 2018 the level recorded was lower than other boreholes on site. All boreholes were complaint with the 150mg/l trigger limit for the entirety of 2018.

Figure 8 shows that Nickel in the boreholes has remained low during 2018. The highest recorded reading was 0.017mg/l in BH25, this is below the trigger limit of 0.02mg/l set on BH22, BH23, BH24, BH25 and BH26. BH22 followed similar trends to that of chloride and ammoniacal nitrogen, with an increase from January to April 2018, followed by a slow decrease to October with a result of 0.005mg/l.

Excluding BH22 the highest recorded reading in 2018 was 0.008mg/l in July, this was during a peak experienced in all boreholes.

Table 3 shows hazardous substances detected in groundwater during 2018.

2.3 Surface Water Monitoring

Five surface points are required to be monitored under the Phase III permit on a monthly basis. The table below summarises the surface water monitoring points currently monitored under the latest permit variation (EPR/BV4495IX/V004) and its location. As stated previously, SOK G is a new surface water monitoring point which was commissioned following the issue of the latest permit variation in 2016.

Sample	Description	Location
91204002	SOK B	Southern edge of site, west of the shooting school
91204004	SOK D	Southern edge of site, east of the shooting school
91204005	SOK E	Northern boundary of permit area
91204006	SOK F	Northern boundary of permit area
91204007	SOK G	Northwest of the site, adjacent to the Leachate Treatment Plant

Following its commissioning in early 2016, SOK G has been the only sampled surface water monitoring points as all other monitoring points were dry or an insufficient volume of water available. Table 4, Figures 9 - 10 and Appendix D show the results in SOK G during 2018, after April 2018 SOK G had insufficient sample volumes to take a sample. It should be noted that SOK G is a stagnant body of water and is, therefore, more susceptible to recording parameter breaches.

Figure 9 shows the Ammoniacal Nitrogen recorded in SOK G are lower in 2018 than 2017. From January until April 2018 the results recorded were below the limit of detection for ammoniacal nitrogen. Figure 10 shows the chloride recorded in SOK G. Since February 2017 the levels of chloride have not breached the trigger limit of 50mg/l. Levels peaked in 2018 with a result of 49.9mg/l, however this was a spike as can be seen by the two lower results recorded either side.

The Surface Water Management Plan Map can be reviewed in Appendix F.

2.4 Leachate Monitoring

Given that all cells at Attlebridge Landfill Site are non-operational and the site is fully capped, the latest permit variation (EPR/BV4495IX/V004) states that leachate levels should be monitored Quarterly. To

demonstrate our progress in reducing leachate levels, we submit a Schedule 5 Notification on a Monthly basis. We will continue to monitor in accordance to the submitted Leachate Action Plan until instructed by the Environment Agency. Furthermore 6 monthly reports are completed by external consultants and these are also submitted to the Environment Agency.

The trigger limits for leachate levels are given in 'Depth from Base' and are outlined below:

- Monitoring wells = 1m from base
- Extraction wells = 2.5m from base

Table 5 and Figures 11 – 17 demonstrate that leachate levels across Phase III have reduced throughout 2018.

Cell A

Figure 11 demonstrates that through 2018 there has been a continued overall decline in leachate levels. At the start of 2018 during the wet period leachate levels rose in both the monitoring points and the sump, peaking in June 2018. The levels then started to decline at a rapid rate for the remainder of the year. The levels became compliant with proposed limits of 5.5m in sumps and 4m in monitoring points in October and November, into December. We expect levels to remain low and compliant with the proposed limits.

Cell B

Figure 12 illustrates that levels have fluctuated in cell B, however remained low and generally compliant with the proposed trigger limits of 5.5m in sumps and 4m in monitoring points. The levels in LMP2CB have stayed below 4m during 2018 and followed the trend of the sump. LMP1CB has risen above 4m twice, in April and December, however the remainder of the year it was below 4m.

Cell C

Cell C leachate levels for all three points track the same pattern throughout the data set with all three wells responding in the same way, as can be seen Figure 13. The graph demonstrates that leachate levels in Cell C have followed the same seasonal trend in 2017 and 2018. The wells have recorded low readings at the beginning of the year and then levels have begun to rise. Levels peaked in July in 2018 and May in 2017 before reducing down to levels similar to the beginning of the year. In 2018 the rise and fall of leachate levels was quicker than in 2017, which had slow increases of levels. Levels have finished 2018 compliant with proposed limits of 5.5m in sumps and 4m in monitoring points.

Cell D

Leachate levels in Cell D (Figure 14) again all wells follow the same downward trend, showing connectivity between the three points. The leachate level decline in cell D has been very gradual through 2017 with a sudden drop in December. The levels then increased again following the heavy

rain during the beginning of 2018. This peaked in May 2018 and then levels started declining at a greater extent than throughout 2017. Levels have all reduced below the proposed limits during 2018.

Cell E

Similarly to Cell D, all three wells in this cell exhibit similar trends at similar elevations (Figure 15). It can be seen in Figure 15 that leachate levels in Cell E continue their gradual decline from 2017 into 2018. A similar increase was seen to other cells in the wetter earlier months, levels peak in April, before declining. By November 2018 levels had become compliant with proposed levels of 5.5m in sumps and 4m in monitoring points.

Cell F

Cell F shows a very consistent declining trend in its leachate levels. Similar to other cells there were rises in January to May 2018, however the increases were at a smaller level compared to other cells. From May 2018 onwards the levels have decreased with levels reaching the proposed compliance limits in November 2018. Small increases are seen from November to December.

Cell G

Similarly to other cells on site, leachate levels in the Cell G wells exhibit the same trends throughout 2018 despite being at different elevations. The levels have followed a similar trend to cell F, with the changes being more gradual rather than sudden drops seen in cell C. Levels have decreased to below the proposed limits in November 2018.

Leachate is removed from the cells and pumped into a Leachate Treatment Plant that uses a single-stage anaerobic biological treatment method. During 2018 23502m³ was discharged into the sewer via the site's Leachate Treatment Plant. Furthermore following the initial report complete by Golder tankering has also been undertaken to increase the volume being removed from the site. A total of 13313m³ was removed via road tanker during 2018. Leachate for all phases of the site are being reviewed by Golder Associates and a risk based leachate management plan and Quarterly review of progress. These Quarterly reviews have been submitted to the Environment Agency when appropriate during 2018.

Leachate in Cells A – G is required to be sampled on Annual basis. Samples are taken from taps installed within sumps, and analysed by an accredited laboratory. Results for this annum can be seen in Appendix G. There are no trigger levels assigned for leachate quality.

2.5 Landfill Gas Emissions from Capped Surface

The emissions from capped surfaces report can be found in appendix H. All cells at Attlebridge are fully capped. The FID survey picked up very small readings around LMP2F and LMP1G. During 2018 we routinely inspected the infrastructure on site to ensure there were no emissions of landfill gas.

3.0 Site Activity

The site is now fully restored and has been seeded during 2017 we have continued to manage and reduce leachate levels across Phase III, with Figures 11 – 17 demonstrating this action. Following the issue of the latest permit variation (EPR/BV4495IX/V004) in 2016, Biffa has adapted its monitoring regime by incorporating SOK G into the surface water monitoring as well implementing leachate and groundwater level and quality reductions.

4.0 Other Reporting Requirement

As per table S4.2 of the permit

4.1 Annual Production/Treatment	
<u>Leachate:</u>	
Disposed of off site	13313m ³ per year
Disposed of to any onsite effluent treatment plant	23502m ³ per year
Recirculated into the waste mass	0m ³ per year
Accepted from offsite for treatment at any onsite effluent treatment plant	0m ³ per year
<u>Landfill Gas</u>	
Combustion in flares	162133m ³ per year
Combustion in gas engine	3970277m ³ per year
Other methods of gas utilisation	0m ³ per year
Average methane content entering landfill gas utilisation or treatment compound	33.44% Vol.
Methane generation rate	422m ³ per hour

As per table S4.3 of the permit

4.2 Performance Parameters		
Parameter	Frequency of Assessment	Annual Total
Energy used (including for leachate treatment)	Annually	35.19MWh

4.3 In-Waste Gas

As per table S3.2 in the permit point source emissions to air are reported annually. This was completed in September 2018 and a report can be found in Appendix H.

As per table S3.8 in the permit Trace Gas reported annually. Trace gas reports were completed in September 2018 and can be reviewed in Appendix I.

A summary of in waste gas monitoring can be found in appendix J.

4.4 Energy Efficiency Review

As per condition 1.3.1(b) of the permit we are required to submit a review every 4 years of whether there are suitable opportunities to improve the energy efficiency of the activities on site. This review can be found in appendix K.

4.5 Efficient use of Raw Materials

As per condition 1.4.1(c) of the permit we are required to submit a review every 4 years of whether there are suitable alternative materials that could reduce environmental impact or opportunities to improve the efficiency of raw materials and water use. The last review was submitted in the 2017 annual report and will next be submitted in the 2021 annual report.

4.6 Avoidance, recovery and disposal of the wastes produced by the Activities on Site

As per condition 1.5.1(b) of the permit we are required to submit a review every 4 years of where changes can be made to ensure that waste produced by activities on site is reduced or avoided, and when waste is produced that it is disposed of in a manner which minimises its environmental impact. The last review was submitted in the 2017 annual report and the next will be submitted in the 2021 annual report.

4.7 Topographical Survey

Condition 3.5.3(a) requires a topographical survey to be carried out annually. This can be found in appendix L.

4.8 Additional Void that is filled by Landfill Waste

As per condition 4.2.2(e) we are required to compare the most recent topographical survey to the previous annual survey in order to calculate how much void has been occupied. Attlebridge has ceased accepting waste or restoration soils, therefore there is no more void to be filled.

4.9 Assessment of Settlement Behaviour

Condition 4.2.2(f) requires us to assess the settlement of the landfill from the previous topographical survey to the most recent.

The settlement appears to be even with limited differential settlement.

4.10 Remaining Capacity

Condition 4.2.2(g) requires us to report the remaining capacity of the landfill. Attlebridge has ceased accepting waste or restoration soils, therefore there is no more void to be filled.

4.11 MEPP

Condition 4.2.2(h) requires the MEPP, which can be found in appendix A.