

Installation of Gas Monitoring Boreholes Shotton Landfill

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Installation of Gas Monitoring Boreholes

1. Introduction

Group Health, Safety and Environment were asked to design and oversee the installation of three gas monitoring boreholes on the Shotton Landfill site. Previously the leachate chimneys had been used for gas monitoring and they were not considered fit for purpose when it came to gas monitoring. The boreholes were to be installed into the waste mass in three separate cells to just above the base of the landfill or the liner (where present). Once installed the three boreholes will be incorporated into the ongoing monitoring plan for the landfill improving the information regarding the landfill gas regime.

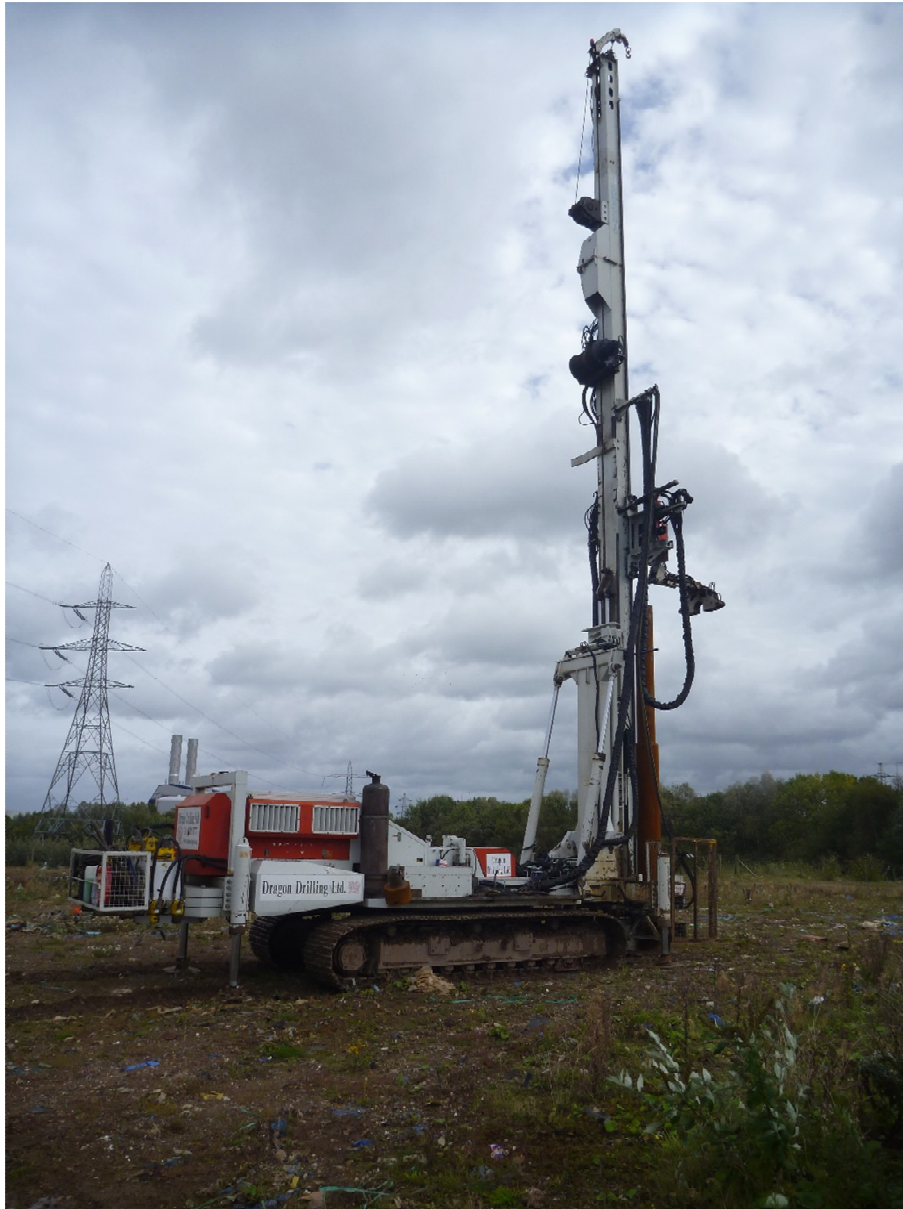
2. Design

The boreholes were designed in line with EA guidance LFTGN03 'Guidance on the Management of Landfill Gas' and verified with NRW prior to the installation. A representation of the design can be found in Figure 1, Appendix A. All boreholes were installed with 100mm HDPE pipework, washed gravel was placed from the base to approximately 0.5m above the slotted case to prevent bentonite slurry entering the well itself. The remaining annulus was filled with pre-hydrated bentonite and a concrete seal at surface. A lockable, steel cover was placed over the borehole and set into the concrete to prevent tampering/vandalism. A removable, screw-top, gas tap was installed on each well.

A member of Tata Steel Land Quality Team acted as the Construction Quality Assurance supervisor for the installation to ensure that the boreholes were installed to the specification and to guide the drilling team as and when required. Descriptions of the soil and depths

3. Installation

Tata Steel contracted Dragon Drilling Ltd to install the three boreholes indicated in the positions in Figure 2, Appendix A. The boreholes were installed using a Comacchio MC1500 tracked drill rig with barrel auger.



Photograph 1: Comacchio MC1500 rig in position at BH1

The auger had outer diameter of 450mm leaving an annulus of approximately 350mm around the well completion. Depths to the base of the landfill had been estimated from topographic surveys of the landfill, it should be noted that the base of the landfill in older cells was not surveyed and therefore the elevation of the surrounding land was used to determine depth. In order to avoid any possibility of penetrating the base of the landfill, each borehole was completed approximately 1m before the liner/base. The maximum depth was marked on to the core barrel by the drillers to prevent any overdrilling.

Water was encountered only in Borehole 1 as it is located in cell 2, which has a clay liner and therefore is expected to retain small volumes of leachate. The base of the well at 4.5mbgl was wet but there was no measureable depth of water. The installation logs from Dragon Drilling can be found in Appendix B of this report.

The typical arisings found in boreholes in cell 0 and cell 1 (BH2 and 3) were silty clay with frequent evidence of filter cake (bright orange and green clay like material) with occasional cobbles of brick, concrete and sandstone. There were also waste from the works such as plastic wrappings and mesh bags deposited with the filter cake. In cell 2 (BH1) the amount of filter cake was much reduced and the volume of construction & demolition wastes, along with other works related waste such as packaging, wrappings etc was increased.



Photograph 2: Typical arisings from drilling in cell 0 and 1, the orange colour is the deposited filter cake.

Once the borehole had been drilled to depth, the well standpipe was placed into the hole and the gravel filled in around the casing making sure that it was secure and central within the hole. The gravel was filled to approximately 0.5m above the level of the slotted casing to make sure the liquid bentonite did not 'short-circuit' into the casing. The top of the gravel was sealed with dry bentonite powder before being filled with the hydrated bentonite slurry.



Photograph 3: Sealing the gravel back with dry bentonite prior to filling the annulus with hydrate bentonite slurry

Wells were installed with a small stick-up from the surface of the landfill to enable easy monitoring. A shallow depth of postcrete (approximately 20-30cm) was placed at the top of the well, hydrated and a lockable steel cover set into position. As mentioned previously, BH1 was left without the steel cover to allow the for the landfill to be brought up to the correct levels before the borehole is completed. The materials required to complete the installation have been left on-site so that this can be accomplished in the future.



Photograph 4: Completed borehole, with concreted, lockable steel cover

4. Borehole Logs

BH1 – Located in Cell 2

Drilling commenced 02/10/2017 at 3:10pm

Easting : 329166

Northing : 370967

0 – 3.5mbgl – MADE GROUND - Dark brown sandy GRAVEL, gravel is sub angular fragments of brick concrete and sandstone. Frequent fragments of plastic and wrappings

3.5 – 4.3mbgl - MADE GROUND – Firm brown silty, sandy CLAY, frequent fragments of paper and plastic with cobbles of brick and concrete

4.3 – 4.5mbgl – MADE GROUND – Large concrete boulder with rebar. Base of the borehole wet with the same description as above.

Installed 3m slotted, 3m plain with 1.5m stick up.

BH2 – Located in Cell 1

Drilling commenced 03/10/2017 at 9am

Easting : 329038

Northing : 370935

0 – 0.05mbgl – MADE GROUND – Topsoil – Light brown sandy CLAY with grass and rootlets.

0.05 – 2.5mbgl – MADE GROUND - Dark Brown Silty CLAY, with frequent pockets of orange to pale brown filter cake.

2.5 – 3.5mbgl – MADE GROUND – Pale green to orange soft CLAY, clay comprising predominantly filter cake.

3.5 – 6.4mbgl – MADE GROUND – Dark brown to black stiff CLAY, with pockets of orange filter cake. Occasional fragments of plastic and wrappings.

Installed 4m slotted, 3m plain with 0.5m stick up.

BH3 – Located in Cell 0

Drilling commenced 03/10/2017 at 11.15am

Easting : 328953

Northing : 371025

0 – 1.5mbgl – MADE GROUND – Light brown soft to firm sandy CLAY with grass and rootlets(Capping Layer), occasional rounded gravel

1.5 - 5.5mbgl – MADE GROUND – Dark brown firm silty CLAY with frequent gravel of limestone, flint and sandstone. Occasional pockets of orange filter cake. Very infrequent black fragments possibly coal (coal like odour).

5.5 – 7mbgl – MADE GROUND – Black stiff silty CLAY, occasional sub-rounded gravel comprising sandstone and flint. Fragments of plastics, paper and other degrading waste materials.

7 – 8.5mbgl – MADE GROUND – Dark brown stiff gravelly CLAY, gravel is coarse sub-angular. Occasional cobbles of brick, concrete and sandstone.

Installed 6m slotted, 3m plain with 0.5m stick up.

Appendix A

Figures

Figure 1

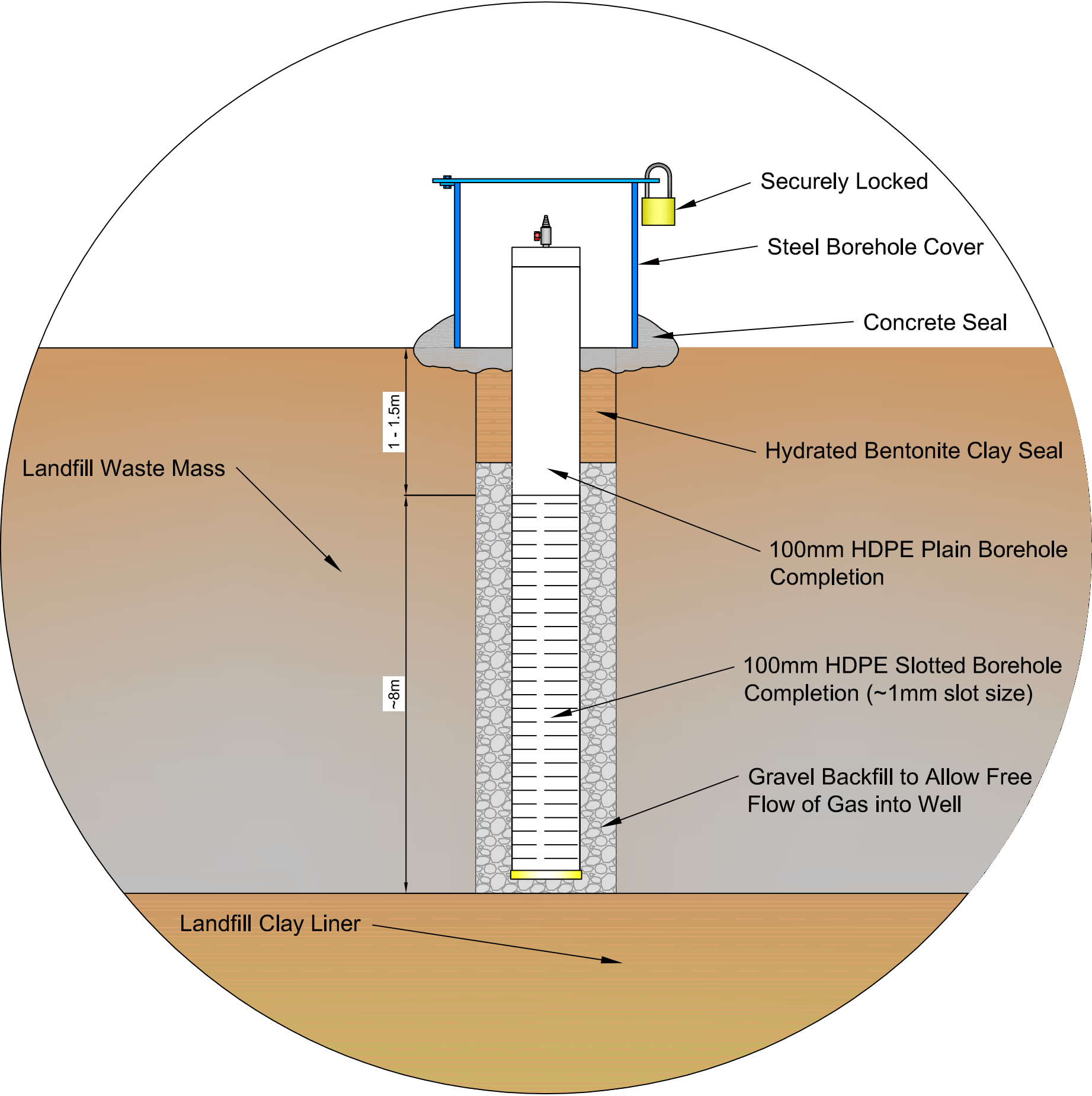


Figure 2



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

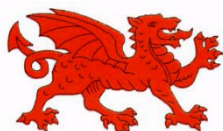
Appendix B

Drilling Logs

DATE: 2/10/2017

BOREHOLE no. 1

SIGNED: Neil Jones (LEAD DRILLER)

**DRILLING LOG**

DRAGON DRILLING (Landfill) Ltd
Graig Lelo Works
Bryn Saith Marchog
LL21 9SD
TEL: 01824 707777

1 2605

SITE :- Tata Steel – Shotton Site 1

BOREHOLE no. 2

DATE: 3/10/2017

OPERATION	SIZE (MM)	FROM DEPTH (M)	TO DEPTH (M)	TOTAL
Set up				1
Drilling Auger	450	GL	6.4	6.4
Plastic CASING	110	0.5	6.4	6.9
Protect. Steel Cover/lock	200			1
Threaded end cap/ gas tap	110			1
Fernco cap	110			1

DEPTH (M)	DESCRIPTION		MATERIAL & DEPTH (M)
			0.5 Plain Casing
GL	Clay		0.0 Bentonite
6.0	Filter cake		
			1.0 Gravel
6.0 – 6.4	Dry Waste		6.4 Gravel

PREDICTED DEPTH (M)	ACTUAL DEPTH (M)	LEACHATE (MBGL)	END CAP	SLOTTED (M)	PLAIN (M)	CASING HEIGHT (MAGL)	STONE (MBGL)	BENTONITE (MBGL)
6.4	6.4		Threaded top cap with gas tap and bottom Fernco caps Protective cover	3.9	3.0	0.5	1.0 – 6.4	0.0 – 1.0

SIGNED:

(CLIENT)

SIGNED: Neil Jones (LEAD DRILLER)

**DRILLING LOG**

DRAGON DRILLING (Landfill) Ltd
Graig Lelo Works
Bryn Saith Marchog
LL21 9SD
TEL: 01824 707777

1 2606

SITE :- Tata Steel – Shotton Site 1

BOREHOLE no. 3

DATE: 3/10/2017

OPERATION	SIZE (MM)	FROM DEPTH (M)	TO DEPTH (M)	TOTAL
Set up				1
Drilling Auger	450	GL	8.5	8.5
Plastic CASING	110	0.5	8.5	9.0
Protect. Steel Cover/lock	200			1
Threaded end cap/ gas tap	110			1
Fernco cap	110			1

DEPTH (M)	DESCRIPTION		MATERIAL & DEPTH (M)
			0.5 Plain Casing
GL	Clay		0.0 Bentonite
1.5	Clay and Filter Cake		
			1.5 Gravel
5.5	Soils and Brick Rubble		
8.0 – 8.5	Dry Waste		8.5 Gravel

PREDICTED DEPTH (M)	ACTUAL DEPTH (M)	LEACHATE (MBGL)	END CAP	SLOTTED (M)	PLAIN (M)	CASING HEIGHT (MAGL)	STONE (MBGL)	BENTONITE (MBGL)
8.5	8.5		Threaded top cap with gas tap and bottom Fernco caps Protective cover	6.0	3.0	0.5	1.5 – 8.5	0.0 – 1.5

SIGNED:

(CLIENT)

SIGNED: Neil Jones (LEAD DRILLER)