




BARRY ENERGY PRODUCTION FACILITY

SITE SPECIFIC SAMPLING PROTOCOL

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1 INTRODUCTION

1.1 Background

Sol Environment has been commissioned by Biomass UK No.2 Ltd (“Client”) to prepare a soil and groundwater monitoring protocol in relation to the Pre-Operational Conditions for the Environmental Permit relating to the Barry Energy Generation Facility at Woodham Road, Barry, CF63 4JE (“the site”).

1.2 Environmental Permitting Regime

The Industrial Emissions Directive (IED) requires that the operator of any IED installation using, producing or releasing Relevant Hazardous Substances (RHS) shall, having regarded the possibility that they might cause pollution of soil and groundwater, submit a baseline report with its permit application.

In accordance with Natural Resources Wales (NRW) Guidance H5 Site Condition Report (Version 5.0 October 2014), the application part of the Site Condition Report (SCR) will fulfil this requirement. The baseline report must enable a quantified comparison to be made between the baseline and the state of the site at surrender. NRW does not require all operators using RHS to carry out intrusive investigations in order to provide baseline data for their application SCR.

In addition to the production of the baseline report, an operator is required to submit a written protocol for the monitoring of soil (at least once every 10 years) and groundwater (at least once every 5 years). The protocol is required to demonstrate how the operator will meet the requirements of specific IED articles:

- Article 14(1)(b): *“appropriate requirements ensuring protection of the soil and groundwater and measures concerning the monitoring and management of waste generated by the installation”.*
- Articles 14(1)(e): *“appropriate requirements for the regular maintenance and surveillance of measures taken to prevent emissions to soil and groundwater pursuant to point (b) and appropriate requirements concerning the periodic monitoring of soil and groundwater in relation to relevant hazardous substances likely to be found on site and having regard to the possibility of soil and groundwater contamination at the site of the installation”.*
- Article 16(2): *“The frequency of the periodic monitoring referred to in Article 14(1)(e) shall be determined by the competent authority in a permit for each individual installation or in general binding rules. Without prejudice to the first subparagraph, periodic monitoring shall be carried out at least once every 5 years for groundwater and 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination”.*

1.3 Site Location

The location of the subject Site is shown on Figure A1, Annex A, centered at approximate National Grid Reference OS X (Eastings) 312610; OS Y (Northings) 167683. The proposed site layout is shown in Figure A2.

The site is located at Woodham Road, Barry, CF63 4JE.

The application site is located within Barry Port at the centre of an industrial and commercial area. The site extends in area to 0.77ha (1.86 acres). It is flat and open with no formal boundary enclosures other than some mounding to prevent vehicular access to the west and south, and steel palisade fencing to the east. There are no buildings present on the site.

Access to the site is gained from a network of industrial estate roads accessed from Millennium Way, a new road to the north of the site serving the docks and new development further west.

The Cardiff to Bridgend railway line is located to the north of that road, and between the road and the site is disused and overgrown land and the dock railway spur line. Immediately adjacent to the site to the west of Woodham Road are a row of Nissen type industrial buildings accessed from Woodham Road that are in active use. To the immediate east of the site is open, unused land and a number of fairly modern warehouse or industrial buildings, a scrap metal yard and a haulage depot. To the south of the site beyond David Davies Road, a railway line and grassed area is located adjacent to the Dock. Across the dock itself are other substantial industrial buildings and open storage of containers and pallets.

The nearest residential development is located on Dock View Road to the north and at a distance of 370m. The road lies at approximately 30m A.O.D at that point, beyond Millennium Way and the railway line.

Table 1 below provides information regarding the surrounding site.

Table 2.1 Site Setting

Direction	Description
North	<p>Immediate Vicinity: Unused Land</p> <p>Within 500m: Unused Land, Ffordd Y Mileniwn, Railway Line, Residential Area (Barry)</p> <p>Beyond 500m: Residential Area, A4055, Barry Road, Gibbons Down</p>
North East	<p>Immediate Vicinity: Truck Paring</p> <p>Within 500m: Industrial Buildings, Scrap Metal Yard, Haulage Depot, Unused Land, Entrance Channel (Dock)</p> <p>Beyond 500m: Unused Land, Industrial Works , Residential Areas (Palmerstown, Dinas Powys)</p>
East	<p>Immediate Vicinity: Truck Parking, David Davies Road</p> <p>Within 500m: Entrance Channel (Dock), Industrial Buildings, Unused Land</p> <p>Beyond 500m: Industrial Buildings, Unused Land, the Coast</p>
South East	<p>Immediate Vicinity: David Davies Road, Grassed Area, Railway</p> <p>Within 500m: Entrance Channel (Dock), Industrial Buildings, Unused Land</p> <p>Beyond 500m: Unused Land, the Coast, Bristol Channel</p>
South	<p>Immediate Vicinity: David Davies Road, Grassed Area, Railway</p> <p>Within 500m: Entrance Channel (Dock), Industrial Buildings, Atlantic Way</p> <p>Beyond 500m: Unused Land, the Coast, Bristol Channel</p>
South West	<p>Immediate Vicinity: Woodham Road, Nissen Industrial Buildings</p> <p>Within 500m: Entrance Channel (Docks)</p> <p>Beyond 500m: Barry Island, Jackson Bay, Whitmore Bay, Bristol Channel</p>
West	<p>Immediate Vicinity: Woodham Road, Nissen Industrial Buildings</p> <p>Within 500m: Unused Land, Railway, Cory Way, The Vale Glamorgan Council, Residential Buildings</p> <p>Beyond 500m: Residential Properties, Waterfront Retail Park, Docks, Barry</p>
North West	<p>Immediate Vicinity: Woodham Road, Nissen Industrial Buildings</p> <p>Within 500m: Unused Land, Ffordd Y Mileniwn, Railway Line, Residential Area (Barry)</p> <p>Beyond 500m: Barry</p>

The Natural Resources Wales flood risk map indicates that the site does not lie within an area where there is a risk of flooding from rivers and the sea. The southern boundary of the site lies immediately adjacent to land which has a low risk of flooding. This is land assessed as having a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%).

According to TAN 15: Development and Flood Risk Development Advice Map the site is located in Zone B which is defined as areas known to have been flooded in the past. The site lies just outside of Zone C2 which is defined as land without significant flood defenses.

2 GROUND CONDITIONS AND CONTAMINATIVE STATUS

The site has been investigated thoroughly and site condition has been established as part of the H5 assessment approved by Natural Resources Wales.

The only major historical development on site was the construction of railway sidings through the site in the 1900s. These were removed by the 1990s and the site has remained predominantly undeveloped since.

Due to the site having minimal development history, the likelihood for contamination is very unlikely.

Previous reports submitted as part of the H5 assessment have established that the site neither has a potentially contaminative history nor is likely to have the potential for significant contamination during the lifetime of the proposed use as a renewable energy (biomass) power station.

The H5 assessment report states that that none of the current or historical adjacent site and land uses are considered to give to the potential for significant site contamination or cross boundary pollution issues. It is concluded that due to the proposed development being located on hardstanding, the risk to site contamination is very low.

Due to the layout and zoning of the site, the Applicant proposes that 4 (four) permanent monitoring wells are installed at the locations shown in Figure 1.

These monitoring wells (BH1, BH1, BH, BH4) will be maintained throughout the lifetime of the permit and be used to monitor groundwater as required.

The site investigation relating to the installation monitoring well suite has been completed as part of the permit pre-operational conditions and submitted to Natural Resources Wales as required.

All detail in relation to the groundwater level, flow direction and contamination is provided within site investigation and groundwater monitoring report and will be updated once the findings of the baseline soil and groundwater monitoring well are installed.

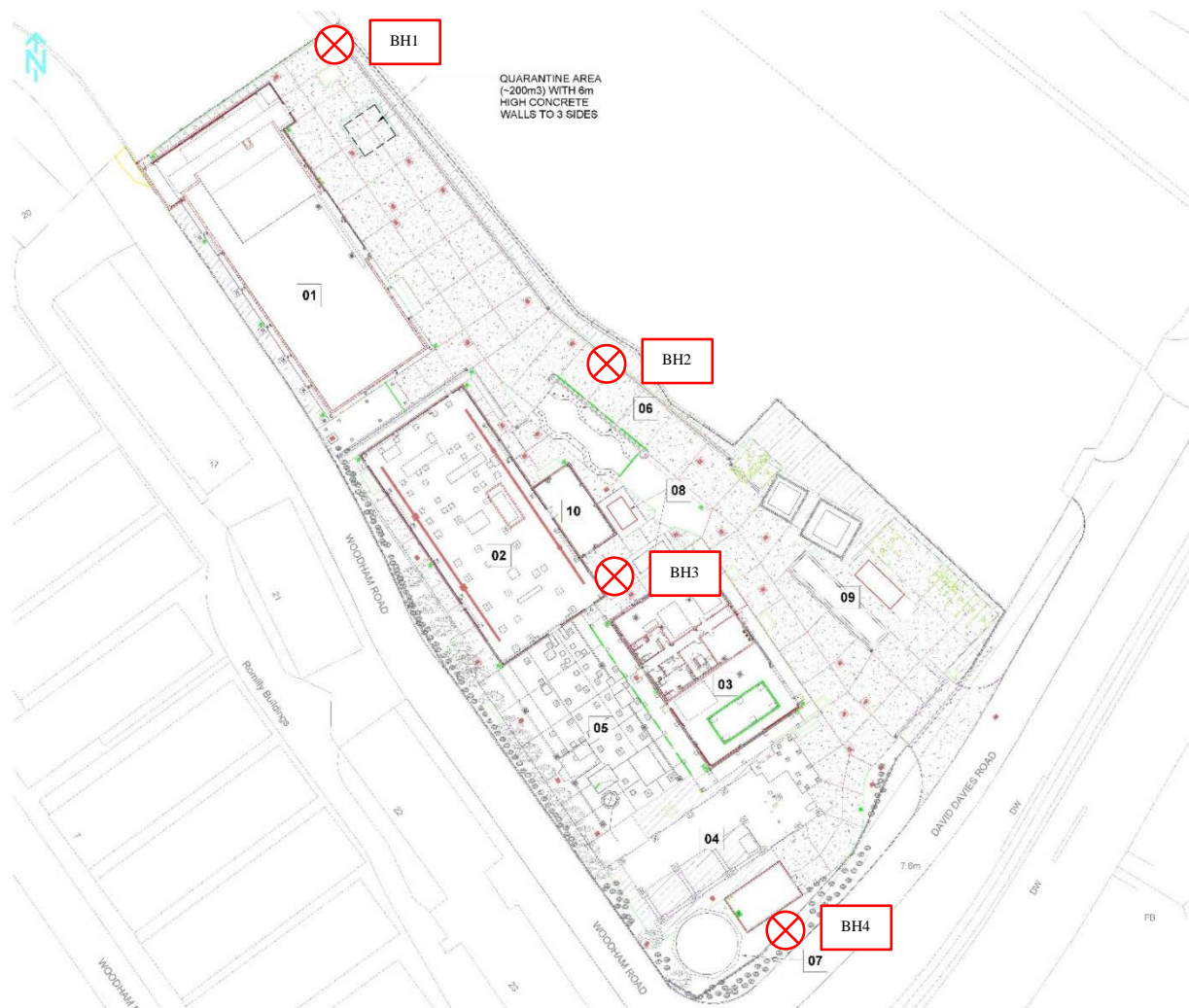


Figure 1: Fixed Monitoring Well Positions (Planned Locations)

3 CONTAMINATION RISK ASSESSMENT

3.1 Introduction

According to the IED, on-site groundwater quality must be assessed every five years and the soil quality every 10 years.

It is intended that the site ground water monitoring well network (BH1, BH2, BH, BH4) are utilised for this purpose and that ground water monitoring is undertaken on a 5 year cycle and throughout the lifetime of the Permit.

It should be noted that according to the NRW guidance document H5 Site Condition Report (Version 5.0 October 2014) it states that periodic monitoring of groundwater and soil may not be required if appropriately assessed i.e. no pollution emissions have occurred on-site and that pollution prevention measures have been in place throughout the life cycle of the site.

Furthermore, Article 16(2) of the IED states that periodic monitoring can be '*based on a systematic appraisal of the risk of contamination*'.

As such, if the quantities of hazardous substances used, produced or released at the site or the ongoing monitoring of the groundwater suggests that there is no significant possibility for the additional contamination of soil or groundwater, then it is justified that no additional soil or groundwater monitoring is undertaken.

On this basis, no additional soil investigation works will be carried out on site unless;

- i) There has been a notable pollution incident either on or in close proximity to the site;
- ii) There has been a detrimental change in the characteristics of the groundwater on site;
- iii) The risk appraisal indicates a significant increase in risk with regards to soil and groundwater contamination.

The site will operate an Environmental Management System (EMS) which will ensure that the site is effectively managed, operated and maintained to minimise the risks of pollution.

The EMS will contain processes and procedures to deal with accidents, incidents, any non-conformances and complaints, such that risks to groundwater and soils are minimised.

3.2 Assessment Procedure for Additional Monitoring

3.2.1 Identify hazardous substances that are currently used, produced or released at site

A list of any hazardous substances in use on site, which could have an effect on soil or groundwater pollution, has been compiled and completed as part of the site permit application documentation and associated site condition reports (H5 Assessment).

This list will be maintained by the operator as part of the site Environmental Management System – ‘*Hazardous Material Inventory*’ and will also include (but not be limited to) all previously identified contaminants in previous site (or near site) investigation reports.

Due to the nature of the operations at site the hazardous materials and substances in use at site are limited to the following:

- Oils / Hydrocarbons (Diesel Range Hydrocarbons, Turbine oils and hydraulic oils etc);
- Urea (ammonia containing chemicals);
- Hydrated Lime; and
- Water Treatment Chemicals (Hydrochloric Acids, Sodium hydroxide, hypochlorite etc).

3.2.2 Identify Relevant Hazardous Substances

The potential pollution risk of each hazardous substance will be identified within the hazardous Materials Inventory and identify any pollution prevention controls necessary to ensure that the potential to cause pollution of soil and groundwater is minimised.

All hazardous materials and substances will be controlled in line with established Natural Resources Wales guidance and pollution prevention controls.

Any identified substances not previously identified within the Hazardous Materials Inventory, should be taken forward for further consideration.

Notwithstanding the above, in order to confirm the baseline conditions and to provide a detailed initial assessment of the site at the commencement of operations, the soil and groundwater in the newly installed monitoring wells shall include the following generic suite of hazardous substances;

- Asbestos (soils only);
- General Inorganics (pH, Free cyanide, total sulphate as SO₄, Sulphide, Total Sulphur);
- Speciated PAH's;
- Total PAH;
- Heavy Metals / Metalloids;
- Monoaromatics;
- Petroleum Hydrocarbons;
- Volatile Organic Compounds (VOC's); and
- PCB's.

3.2.3 Assessment of the Site-Specific Pollution Possibility

Each substance identified for further consideration should be considered to determine if whether any circumstances exist which may result in the release of the substance in sufficient quantities to represent a pollution risk, either as a result of a single emission or as a result of accumulation from multiple emissions.

Specific issues to be considered will include:

- The quantity of each hazardous substance handled, produced or emitted in relation to its environmental effects;
- The location of each hazardous substance on the site e.g. where it is or will be delivered, stored, used, moved around the site. As such, it is important to understand the characteristics of the soil and groundwater of the site;
- Presence and integrity of containment mechanisms, nature and condition of site surfacing, location of drains, services or other potential conduits for migration; and
- The method of storage, handling and use of relevant hazardous substances.

A detailed physical inspection of the site is to be undertaken to verify the integrity and efficiency of measures to prevent releases occurring including:

- Whether structures and site surfacing are cracked or damaged. Identify whether joints or cracks are present in the vicinity of potential emission points;
- Whether there are signs of chemical attack to concrete surfaces;
- Whether process drains, manholes, gullies and open drains are in good condition;
- Identify drainage routes, service corridors and outfalls;
- Identify signs of emissions already having been made, examine their nature and content and consider the likelihood of emission recurring; and
- Identify whether any direct or indirect emissions of hazardous substances to ground or groundwater occur on-site.

However, if an emission occurs then investigation and monitoring will be required. Circumstances under which emissions may occur include:

- **Accidents/incidents** such as a leaking tank, accidental discharge, leaks from drain ruptures;
- **Routine operations** such as small spills from transfer of product, leaks from broken or blocked drains, cracks in hardstanding; and
- **Planned emissions**, e.g. discharges to land or groundwater. However, please note that the site operations are unlikely to involve planned emissions.

Based on the above, an assessment can be made if soil and groundwater monitoring of the site is required. If there is no significant possibility of soil and/or groundwater contamination resulting from the site's activities, then there is a justification for not undertaking monitoring. However, if the possibility does exist, then monitoring is required.

This assessment will to be undertaken throughout the lifetime of the Permit.

4 Soil and Groundwater Monitoring Protocol

4.1 Introduction

Should soil and groundwater monitoring of the site be required as assessed by the risk-based approach outlined in *Section 3*, those areas of the site posing the greatest contaminative risk will be identified and given the highest priority for monitoring.

4.2 Identification of Sample Locations

A similar procedure, as outlined in *Section 3.2*, will be used to identify the locations which should be targeted:

- Identify the hazardous substances that are currently used, produced or released on-site, which could have an effect on soil or groundwater pollution;
 - The potential pollution risk of each substance must be identified to determine if it has the potential to cause pollution of soil and groundwater;
 - Each substance identified for further consideration should be considered in the context of the site to determine whether circumstances exist which may release the substance in sufficient quantities to represent a pollution risk.
- The method of storage, handling and use of the hazardous substances needs to be identified; and
- A detailed physical inspection of the site is to be undertaken to verify the integrity and efficiency of measures to prevent releases occurring.

4.3 Exploratory Hole Excavation

The excavation of all exploratory locations should be done so using clean drilling methods, i.e. no oils or other contaminative fluids will be used or added during drilling.

The specific drilling techniques deployed on-site will be determined as a result of the assessment process outlined in *Section 4.2*.

4.4 Soil Logging and Sampling

During the site investigation, the ground conditions are to be recorded to provide information on the condition of the soils and groundwater on the site. Lithological logs will be prepared for all excavations.

All samples will be examined by an experienced field scientist and inspected for visual and olfactory evidence of contamination. The condition, colour and odour of each sample will be noted and recorded in the field log. The soils will be logged in accordance with accepted international

logging nomenclature and a detailed photo-log will be kept of all sampling activities, locations and samples along with GPS co-ordinates of each sample location. It is estimated that a minimum of 10 soil samples shall be obtained for analysis.

All retained soil samples will be collected and immediately placed into containers appropriate to the type of analysis being undertaken and stored in cool boxes (with ice packs) maintained at a low temperature, to avoid the loss of volatile compounds. All samples will be stored and transported, under appropriate chain of custody documentation and shall be transported to the laboratory immediately after sampling.

4.5 Soil Gas Headspace Testing

Soil samples will be scanned on-site with a portable photo-ionisation detector (PID); this provides a rapid screening method for the presence of volatile organic compounds in soils, which could be indicative of organic contamination such as petroleum derived hydrocarbons. It is not a substitute for laboratory chemical analysis; rather it can be used to help determine which samples should be analysed.

Headspace testing is undertaken by placing the sample in a sealed plastic bag and then agitating it before inserting a PID probe into the headspace above the sample. The device will give a linear response to the presence of organic vapours in the headspace, but will not determine the species present.

4.6 Monitoring Well Installation

Four groundwater monitoring wells¹ shall be installed in order to facilitate groundwater monitoring. The details of the exact locations, construction and installation is provided within the Groundwater Monitoring Report.

In the event of an identified on-site or offsite pollution incident that has the potential for sub surface / groundwater contamination, then advice will be sought from technically competent third parties on the need to install additional groundwater monitoring wells. All locations for any additional boreholes shall be agreed with Natural Resources Wales prior to installation.

The following is the minimum information required for constructing a monitoring well:

- Details of the geology (*e.g.* aquifer thickness, nature of strata *etc.*);
- Information on perched groundwater and confining/low permeability layers;
- Groundwater levels; and
- Borehole depths.

The final details of the monitoring well installation will be designed on-site after examination of the actual subsoil and groundwater conditions found.

¹ A minimum of three groundwater monitoring well are required in order to determine groundwater flow direction, however a total of four monitoring locations have been identified for the initial assessment.

The wells will generally consist of a screened section (slotted HDPE pipe) in the horizon of interest and blank riser casing (HDPE tubes) to the surface.

The filter pack, which should be washed and inert, will surround to the well screen will be inert and clean and suitable for the geological formation. The pack will be placed into the annulus of the borehole and the monitoring well to at least 0.5m above the well screen and covered by a layer of fine silica sand (approximately 0.3m thick).

A bentonite slurry will be added to the top of the filter pack to form a plug not less than 0.5m in thickness. The main purpose of bentonite is to separate and seal out surface water or any other perched groundwater.

The monitoring wells will be sealed at the surface with concrete and flush fitting covers.

4.7 Groundwater Monitoring

Monitoring wells will be developed to ensure a good interface within the groundwater bearing strata, by purging and removing standing water amounting to approximately three well volumes. Each of the groundwater wells were left for a minimum of 2 hours to stabilise (post development) before sampling.

Prior to sampling, the wells will be dipped using a groundwater interface probe to ascertain groundwater levels within the wells and the presence (if any) of free-phase product. Following this, a representative groundwater sample from each well will be obtained using a dedicated disposal plastic bailer. Field observations will be recorded during groundwater monitoring, including colour and odour (if present).

All retained groundwater samples will be collected and immediately placed into containers appropriate to the type of analysis being undertaken and stored in cool boxes (with ice packs) maintained at a low temperature, to avoid the loss of volatile compounds. All samples will be stored and transported, under appropriate chain of custody documentation and shall be transported to the laboratory immediately after sampling.

4.8 Decontamination

All sampling equipment shall be decontaminated between sampling locations so as to prevent any cross contamination.

Disposable nitrile gloves will be worn for handling each sample and changed as necessary to prevent cross-contamination and protect field operatives from skin contact.

4.9 Sample Analysis Rationale

As outlined in *Section 3.2*, the assessment procedure will highlight the potential substances which may impact the underlying soils and groundwater. As such, the soil and groundwater samples will

be analysed for these substances and contaminants generally associated with industrial sites and the site's previous use.

4.10 Sample Transportation

All samples dispatched to the laboratory will be despatched with the completed chain of custody documentation. The transportation boxes will be clearly marked as fragile and address labels will be securely fixed to the outside of the boxes. Custody seals will be attached to the transportation boxes to provide a tamper proof seal.

4.11 Laboratories

All chemical analysis shall be undertaken by a UKAS and MCERTS accredited laboratory. Discussions will be held with the laboratory prior to the commencement of any works to determine the quantity of sample required and the particular containers to be used.

4.12 Site Supervision

All works will be supervised by an experienced environmental land scientist at all times.

4.13 Guidance and Best Practice

This protocol has been prepared with due consideration to current guidance and industry best practice including:

- BS 10175:2011+A1:2013 Code of Practice for Investigation of potentially contaminated sites;
- BS EN ISO 14688-1:2002+A1:2013 Geotechnical investigation and testing. Identification and classification of soil. Identification and description;
- BS EN ISO 14688-2:2004+A1:2013 Geotechnical investigation and testing. Identification and classification of soil. Identification and description;
- BS ISO 5667-11:2009, BS 6068-6.11:2009 Water quality. Sampling. Guidance on sampling of groundwaters;
- Guidance on the design and installation of groundwater quality monitoring points, EA Science Report, SC020093, 2006;
- Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water, Environment Agency, 2003;
- Principles and Practice for the Collection of Representative Groundwater Samples, CL:AIRE Technical Bulletin TB3, 2008; and
- European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions.