

28 July 2014  
Project No. 09-4113

British Energy Coast  
Business Cluster  
Tender Opportunities  
Cumbria, UK

**REQUEST FOR PROPOSAL  
GEOTECHNICAL AND HYDROGEOLOGICAL DRILLING SERVICES  
MOORSIDE SITE  
CUMBRIA, UNITED KINGDOM**

To Whom It May Concern:

RIZZO Associates (RIZZO) is providing a proposal for Geotechnical and Hydrogeological Site Characterisation Services at the Moorside Site in Cumbria, UK. As part of this effort, Geotechnical and Hydrogeological services are required. .

You are hereby invited to submit a bid for consideration via this Request for Proposal (RFP).

This RFP is comprised of this Letter and the following Attachments:

|                            |   |
|----------------------------|---|
| <b><i>Attachment A</i></b> | Technical Specification                     |
| <b><i>Attachment B</i></b> | Form of Contract and Insurance Requirements |

Please submit the following information in a complete bid package. Incomplete bids will not be considered.

1. Response to Technical Specifications (***Attachment A***), including pricing. Confirm understanding of the Scope of Work and provide a plan to accomplish the desired scope. Confirm understanding and conformance to the Quality Assurance requirements.
2. Acknowledgement of receipt and understanding of the Form of Contract and Insurance Requirements (***Attachment B***). Confirm agreement with the Form of Contract and insurance requirements or explain any points of disagreement. These will be negotiated following award of the Contract.
3. Valid Certificates of Insurance (***Attachment B***).
4. List of affiliations with contractor registrars, e.g., Achilles, CHAS, etc.
5. Company Statement of Qualifications (SOQ); discussion on experience, knowledge, and qualifications.
6. Schedule – earliest date available to start.

Proposal evaluation will consider qualifications, schedule readiness, quality assurance experience, and responsiveness in addition to price. RIZZO is not bound to select the lowest bid or any responding bidder. PRICING PROVIDED TO RIZZO MUST BE THE SAME OR LOWER THAN PRICING PROVIDED TO ANY OTHER ENTITY FOR WORK ON THE MOORSIDE SITE.

Bidders are required to notify RIZZO by 8 August 2014 if they intend to respond to this RFP. Bids are due by Noon, London time on 23 August 2014. Bids are to be submitted electronically to [Moorside@rizzoassoc.com](mailto:Moorside@rizzoassoc.com).

We are anticipating providing notification of award for this scope in September with mobilisation expected in late October 2014.

If you have any questions, provide them in writing to [Moorside@rizzoassoc.com](mailto:Moorside@rizzoassoc.com) by 16 August 2014. All responses will be provided in writing to all bidders.

Sincerely,  
***RIZZO Associates***

Melissa L. Dubinsky, Ph.D.  
Vice President

MLD/sdr

Attachments



**ATTACHMENT A**  
**TECHNICAL SPECIFICATIONS**





GEOTECHNICAL, GEOLOGICAL, AND HYDROGEOLOGICAL DRILLING  
TECHNICAL SPECIFICATION  
PHASE 1

MOORSIDE SITE  
CUMBRIA, UNITED KINGDOM

14-5306  
28 JULY 2014

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**GEOTECHNICAL, GEOLOGICAL, AND  
HYDROGEOLOGICAL DRILLING  
TECHNICAL SPECIFICATION  
PHASE 1**

**MOORSIDE SITE**

**CUMBRIA, UNITED KINGDOM**



# TABLE OF CONTENTS

|  | <b>PAGE</b> |
|--|-------------|
| LIST OF TABLES .....   | 5           |
| 1.0 INTRODUCTION .....   | 6           |
| 2.0 SCOPE OF WORK.....   | 7           |
| 2.1 UTILITY CLEARANCE .....  | 8           |
| 2.2 CORING BOREHOLES .....   | 8           |
| 2.2.1 Deep Rotary Core Boreholes with Continuous<br>Sampling (BH).....                               | 8           |
| 2.2.2 Rotary Core Boreholes with Piezometers (BH-Pz and<br>BHR-Pz) .....                             | 9           |
| 2.2.3 Requirements for Rotary Core.....  | 9           |
| 2.3 DESTRUCTIVE AND IN-SITU DRILLING AND TESTING .....   | 10          |
| 2.3.1 Destructive Borings for Pumping Wells (DBH-W) .....  | 10          |
| 2.3.2 Destructive Borings for Piezometers (DBH-Pz) .....   | 11          |
| 2.3.3 Standard Penetration Test Borings (SPT).....   | 13          |
| 2.3.4 Pressuremeter Borings (PR) .....   | 13          |
| 2.3.5 Packer Testing .....   | 15          |
| 2.3.6 Permeability Testing.....  | 15          |
| 2.3.7 Pump Tests .....   | 16          |
| 2.3.8 Wireline Geophysics .....  | 17          |
| 2.3.9 P-S Logging.....   | 19          |
| 2.4 PARTICULAR INSTRUMENTATION AND MONITORING<br>REQUIREMENTS (SISG, SECTION 9, S1.14) .....         | 19          |
| 2.5 PARTICULAR SAMPLING REQUIREMENTS (SISG, SECTION 7,<br>S1.12).....                                | 20          |
| 2.5.1 Preservation and Storage of Samples from Rotary<br>Cores Scheduled for Laboratory Testing..... | 20          |
| 2.5.2 Preservation and Storage of Samples from Rotary<br>Cores.....                                  | 22          |
| 2.5.3 Sampling Frequency .....   | 23          |
| 2.6 BOREHOLE ABANDONMENT.....  | 25          |
| 2.7 DELIVERABLES .....   | 25          |
| 2.7.1 Data Format .....  | 25          |
| 2.7.2 Borehole Logs .....  | 25          |



**TABLE OF CONTENTS  
(CONTINUED)**

|       | <b>PAGE</b>  |
|-------|--|
| 2.7.3 | Drilling Parameter Recording.....26  |
| 2.7.4 | Pressuremeter Testing .....26  |
| 2.7.5 | Standard Penetration Testing (SPT) .....27                                 |
| 2.7.6 | Boreholes for Intrusive Ground Radiological<br>Investigation BHR-Pz.....29 |
| 2.7.7 | Monthly Reports.....30   |
| 2.7.8 | Pumping Test.....30  |
| 2.8   | SCHEDULE, FACILITIES, AND SITE CONSTRAINTS.....30                          |
| 2.9   | STAFFING .....31   |
| 3.0   | QUALITY, HEALTH, SAFETY, AND ENVIRONMENTAL<br>REQUIREMENTS.....32          |
| 3.1   | PERSONNEL QUALIFICATIONS .....33   |
| 4.0   | SUBMITTALS .....35   |
| 4.1   | PROPOSAL SUBMITTALS.....35   |
| 4.1.1 | Logistics/Plan .....35   |
| 4.1.2 | Health, Safety, and Environmental.....35                                   |
| 4.1.3 | Personnel Qualifications.....35  |
| 4.1.4 | Drilling Equipment, Procedures, and Materials .....35                      |
| 4.1.5 | Duration .....36   |
| 4.1.6 | Previous Experience .....36  |
| 4.1.7 | Subcontractors/Teaming.....36  |
| 4.1.8 | Bill of Quantities .....36   |
| 4.2   | IN-PROCESS SUBMITTALS .....36  |
| 4.2.1 | Daily and Weekly Updates .....37   |
| 4.3   | FINAL SUBMITTALS.....37  |
| 4.3.1 | Records and Boring Logs .....37  |
| 4.3.2 | Final Completion Report .....37  |

**EXHIBIT 1 PROPOSED SITE INVESTIGATION**



## LIST OF TABLES

| TABLE NO. | TITLE                          | PAGE |
|-----------|--------------------------------|------|
| TABLE 2-1 | PROPOSED DRILLING SCOPE.....   | 24   |
| TABLE 2-2 | PROPOSED FIELD TESTS .....     | 24   |
| TABLE 2-3 | PUMP TEST RECORDS TIMING ..... | 25   |





**GEOTECHNICAL, GEOLOGICAL, AND HYDROGEOLOGICAL  
DRILLING  
PHASE 1  
TECHNICAL SPECIFICATION**

**MOORSIDE SITE  
CUMBRIA, UNITED KINGDOM**

**1.0 INTRODUCTION**

The Moorside Site, which is the subject of this Technical Specification, is located adjacent to the Sellafield nuclear facility in Cumbria, United Kingdom (UK). RIZZO Associates (RIZZO), acting as Principal Contractor, will subcontract a firm (the Subcontractor) to perform geotechnical, geological, and hydrogeological drilling and sampling at the Site.

NuGen is developing a nuclear power plant at the Moorside Site. The Nuclear Decommissioning Authority (NDA) is the land owner. The Subcontractor will report to RIZZO technical and management leads. Interactions between NDA, Local Planning Authority, and any other local authorities will be the responsibility of the NuGen Land Manager with input from RIZZO.

The Site consists of unconsolidated glacial drift overburden above sedimentary rock (primarily sandstone). The glacial drift ranges from 0 to 70 meters (m) in thickness, with the thickest deposits located in the northeast portion of the Site, and thinning towards the southwest.



## 2.0 SCOPE OF WORK

This Technical Specification describes the requirements of the Geotechnical, Geological, and Hydrogeological Drilling Phase 1 Program to be performed at the Site. The investigation will consist of 85 borings that will range from approximately 30 m to 150 m vertical depth (*Exhibit 1* and *Table 2-1*). Following the drilling of the borings, in-situ tests will be performed as listed in *Table 2-2*.

The objective of the geotechnical, geological, and hydrogeological drilling program is to obtain data of high quality for the characterization of the Site. A topographic survey (to be performed by others) will be required to locate the initial and as-built locations of the borings.

For pricing purposes, assume that drilling mud/water must be captured and stored on-site until it has been tested for contamination. Contamination testing will be performed by RIZZO or NuGen. Following contamination testing, drilling mud/water is to be disposed in accordance with Environmental Agency (EA) regulations. Should the drilling mud/water be found to be contaminated, this will constitute a Changed Condition and additional consideration will be given for disposal, or disposal will be handled by RIZZO and/or NuGen. Do not include contamination testing or contaminated materials disposal costs.

The Subcontractor is to supply all equipment and materials used in drilling and sample collection, including core boxes, sample jars, and drilling water/mud.

Once completed, boreholes must be grouted using a cement-bentonite grout, as detailed in *Section 2.6*.

*Exhibit 1 and Table 2-1* summarize the borings to be advanced. Any change from the currently specified location must be made after written approval by the RIZZO Field Team Leader, by means of a field change notice.

Borehole drilling, logging, and sampling shall be carried out in accordance with British Standards: BS EN ISO 22475-1:2006, BS EN ISO 14688-1:2002, BS EN ISO 14689-1:2003, and BS 5930:1999.

If the drilling operations cause any soil instability or create borehole sidewall voids, the drilling hole shall be protected by a temporary casing.



Prior to the start of the Works, the Subcontractor is to provide method statements detailing methods, materials, and equipment intended for use for RIZZO's approval.

Drilling fluids made with biodegradable polymeric additives or fluids with clay additives are acceptable alternatives to drilling utilizing a water-based drilling fluid.

During drilling work, all incidents are to be recorded on the driller's logs, in particular water losses (flow and volume estimated), water level increases, and variation in nature of soil extracted.

## **2.1 UTILITY CLEARANCE**

The Subcontractor is to deploy a suitably trained operative using a cable avoidance tool (CAT) to check all pit and trench locations before starting work. The Subcontractor is to undertake service clearance work in accordance with HSE47 publication – Avoiding Danger from Underground Services.

For all boreholes, a pit of dimensions 0.6 m x 1.0 m x 1.2 m depth is required to be dug before starting drilling to check for buried utilities / services.

All pits and trenches are to be preceded by a hand dug pit to check for buried services. As part of the as-constructed information, the Subcontractor is to include all reports of service inspection pit construction and examination prior to intrusive borehole works, including coordinates, drawings, and photographs. Prior to excavations, the Subcontractor is to excavate a starter hole by non-powered tool within the area of the service inspection pit, previously excavated.

## **2.2 CORING BOREHOLES**

### **2.2.1 Deep Rotary Core Boreholes with Continuous Sampling (BH)**

The Subcontractor will advance 4 deep rotary core boreholes, including continuous core sampling, to a depth of 150 m below ground level (BGL).

The boreholes are to be carried out with triple core-barrel with an internal diameter of no less than 101 mm (4-inch) and shall be continuously sampled for the full length of the borehole. Samples must be undisturbed (class 1).



The boreholes shall be constructed to allow wireline geophysical logging and P-S logging, if requested.

### **2.2.2 Rotary Core Boreholes with Piezometers (BH-Pz and BHR-Pz)**

The Subcontractor will advance 8 rotary core boreholes, including continuous core sampling, to a depth of 50 m BGL. An additional 9 boreholes will be advanced to a depth of up to 30 m BGL for the purposes of radiological investigation.

The boreholes are to be carried out with triple core-barrel with an internal diameter of no less than 101mm (4-inch) and shall be continuously sampled for the full length of the borehole. Samples must be undisturbed (Class 1).

The borehole shall be constructed to allow aquifer protection measures and the installation of monitoring standpipes.

### **2.2.3 Requirements for Rotary Core**

The equipment used shall be a rotary core drilling system, incorporating triple tube core barrels in which the innermost barrel comprises a one piece cylindrical semi-rigid plastic liner of minimum 1 mm wall thickness. The equipment shall be capable of providing 100 mm diameter core of Class 1 standard in accordance with BS EN ISO 22475-1: 2006.

Rotary core drilling shall produce undisturbed continuous cores of 100 mm diameter throughout the length of each core run. Core recovery shall not be less than 90 percent. Initial drill runs will not exceed 0.75 m and subsequent drill runs shall not exceed 1.5 m in length. The core barrel shall be removed from the drill holes as often as may be required to produce the best possible core recovery. Where the core recovery is less than required, the length of the subsequent core run shall be reduced by half and such techniques, equipment, and skills, as necessary to achieve the minimum 90 percent recovery shall be used.

If core recovery is less than 35 percent, it shall be reported to RIZZO for further instruction. The Subcontractor shall have available equipment for undertaking SPTs, if required.

Core recovery of less than those stated above may not be acceptable for payment unless the RIZZO Field Team Leader is satisfied that a greater core recovery is impracticable under the prevailing conditions.



The Subcontractor shall have on Site a range of bits and core springs which will allow the Subcontractor the optimisation of clearance between the cut diameter of the core and the liner. The clearance should be of the order of 1 mm.

The drilling fluid shall be water of drinking quality, air mist, foam, or biodegradable mud subject to the approval of the RIZZO Field Team Leader. Spent flush medium and drill cuttings shall be disposed of appropriately, via a licensed waste transfer agent.

Cores shall be photographed in accordance with Clause 5.6 of the Site Investigation Steering Group (SISG) Specification for ground investigation. The Subcontractor shall use a system for core photography that follows the requirements of Clause 5.6 and does not cause occupational health and safety hazards for the personnel carrying out the work.

The Subcontractor shall estimate and record sample recovery percentages which shall be checked by the RIZZO Field Team Leader, whose decision in respect of recovery percentage is final.

During the drilling operations, all incidents shall be recorded, and in particular the losses of water, with estimates of flow and volume, sidewall or other void formation, rising of the water level, alterations in the type and colour of the mud.

## **2.3 DESTRUCTIVE AND IN-SITU DRILLING AND TESTING**

### **2.3.1 Destructive Borings for Pumping Wells (DBH-W)**

The execution method and equipment shall be submitted for RIZZO approval prior to the start of the survey.

If hydraulically operated drilling is performed, the tool pressure on soil must be kept constant while all other parameters (such as the speed penetration in the soil, the torque applied on drill, and the rotational speed) can vary freely. The control and the management of these parameters must be done automatically (without human intervention). During the execution of these boreholes, the following parameters shall be continuously recorded (at least every second), and be provided on a graph in function of the depth:

- Torque applied on drilling tool (bars or kilopascals [kPa])
- Penetration speed or rate (meters per second [m/s])



- Tool pressure (bars or kPa)
- Rotational speed

Alternatively sonic drilling can be used, continuous sampling of soil is then required and samples can be disturbed.

The minimum inside diameter of the casing for the DBH-W shall be 203.2 mm or 8 inches with a filter pack of 50 mm thick. The boreholes shall be constructed to allow for wireline geophysical logging.

The Subcontractor shall comply with the standard BSI BS 14686:2003 and BS EN ISO 222282 Part 4, 2012.

There are 2 types of wells to be carried out:

- 2 DBH-W shall be performed to investigate the stratum of the superficial drift deposits. These destructive borings shall be drilled to depths of approximately 30 m BGL or to the top of the underlying hard rock formations. They shall be used for pump tests when instructed in writing by the RIZZO Field Team Leader.
- 2 DBH-W shall be performed to investigate the bedrock (solid geology underlying the superficial deposits). These destructive borings shall be drilled to depths of 25 m to 45 m below the top of the underlying rock formations. The minimum depth of the boreholes is 50 m BGL. They shall be used for pump tests when instructed in writing by the RIZZO Field Team Leader.

For pricing purposes, *Table 2-1* gives a total of 4 DBH-W borings, each with a depth of 75 m.

### **2.3.2 Destructive Borings for Piezometers (DBH-Pz)**

The minimum inside diameter of DBH-Pz shall be 50 mm or 2 inches with a filter pack 25 mm thick.

There are 2 types of installations proposed:



- 17 DBH-Pz standpipe installations to investigate the stratum of the superficial drift deposits. These destructive borings shall be drilled to depths of approximately 30 m BGL or to the top of the underlying hard rock formations.
- 13 DBH-Pz standpipe installations to investigate the bedrock. These destructive borings, installed with monitoring standpipes, shall be drilled to 45 m below the top of the underlying bedrock formations. The minimum depth of the boreholes is 50 m BGL.

For pricing purposes, **Table 2-1** gives a total of 30 DBH-Pz borings, each with a depth of 75 m.

Prior to the start of the Works, the Subcontractor is to provide method statements detailing methods, materials, and equipment intended for use for RIZZO approval.

In all circumstances, the borehole depth and diameter must be of sufficient size for the proposed installations.

In order to allow result comparison between tests (nature and resistance of soil layers encountered), during the execution of the boreholes, the tool pressure on soil must be kept constant while all other parameters (such as the speed penetration in the soil, the torque applied on drill, the rotational speed) can vary freely. The control and the management of these parameters must be done automatically (without human intervention).

During the execution of these boreholes, the following parameters shall be continuously recorded (at least every second), and be provided on a graph in function of the depth:

- Torque applied on drilling tool (bars or kPa).
- Penetration speed or rate (m/s).
- Tool pressure (bars or kPa).
- Rotational speed.

These parameters shall be visible and shown graphically in real time, in order to allow the first interpretation during the drilling operations.



### **2.3.3 Standard Penetration Test Borings (SPT)**

The boreholes are performed according to BS EN IS 22475-3:2005.

Boreholes are to be conducted to allow for SPTs at 1.5 m intervals.

Currently the boreholes are scheduled to be completed using cable percussive techniques. The Subcontractor may propose alternatives in his Method Statement subject to RIZZO's prior approval. RIZZO is not obliged to accept all or any of the Subcontractor's proposed alternatives.

The SPTs are to be terminated in solid material (e.g., bedrock) when 'double bouncing' or no penetration is achieved after 50 blows.

Drilling should be advanced to the required test depth for the test. The number of blows (from a slide hammer with a weight of 63.5 kilogram (kg) falling through a distance of 760 mm) needed for the tube to penetrate up to a depth of 450 mm should be recorded and "N-value" determined.

SPT energy measurement in accordance with American Society for Testing and Materials (ASTM) D4633 or BS EN IS 22475-3:2005 must be performed for all rigs used for SPT testing.

### **2.3.4 Pressuremeter Borings (PR)**

Pressuremeter tests are to be performed in 13 borings up to a depth of 50 m. The pressuremeter tests shall be carried out every 2 m.

The Subcontractor shall perform the tests in conformity with one of the following standards: ASTM D4719-87 or NF P94-110.

The diameter of the boring must be adapted to the diameter of the pressuremeter probes. The probes shall be composed of three cells (two holding cells and one central cell). The central cell shall be inflated by water while the holding cells shall be inflated by nitrogen. The standards related to probe calibration shall be scrupulously followed. In particular, the pressure difference between the holding cells and the central cell must be one bar, whatever the depth.





The drilling method shall be adapted to the encountered soils, in order to avoid disturbing the walls of the hole. The drilling methods recommended in the mentioned standards shall be used in function of the encountered soil.

The time, pressures, and volumes of the cells of the pressuremeter equipment must be recorded by an automatic integrated system. The curves must be visible on screen in real time.

Retrieving disturbed samples is not allowed in these boreholes.

Reboring could be imposed after testing, which shall be supported by the Subcontractor. The Subcontractor will have at his disposition, on the worksite, several pressuremeter probes including type E probes (5 MPa) and outer metal shields.

For each pressuremeter test, the Subcontractor is to supply:

- The reference number of the drilling where the test was performed
- The date of the test
- The X, Y, and Z coordinates of the drilling, as well as a location sketch
- The uncorrected test curve
- The rectified test curve
- The reference calibration curve
- The uncorrected and rectified pressures values of  $p_o$ ,  $p_f$ ,  $p_l$ , (numerical and graphical representation)
- The modulus values  $E_m$
- The volume curves as a function of the pressure
- The usual level characteristics and the test equipment
- The characteristics of the probe in use

All borings should be backfilled with clean, low permeability material e.g., bentonite grout to the approval of the RIZZO Field Team Leader.

Boreholes are to be backfilled after completion in accordance with *Section 2.6*.



### **2.3.5 Packer Testing**

The Subcontractor will undertake open borehole or wireline single and double packer permeability testing in the solid geology (rock/ weathered rock) as directed by the RIZZO Field Team Leader and in accordance with BS EN ISO 22282 Part 3, 2012, BS BS6316:1992, and BS ISO14686:2003.

All packers shall have a standard sleeve length of 1 m. The borehole diameter should allow for the largest available packer into the borehole after allowing for sufficient clearance for positioning and extraction. Details of the packer to be used will be confirmed by RIZZO at a minimum of one week prior to the test being carried out.

The length of the test zone will be as instructed by the RIZZO Field Team Leader depending on the borehole conditions encountered.

The Subcontractor is only to undertake Lugeon/injection packer testing, using only clean potable water from mains supply except where directed otherwise by the RIZZO Field Team Leader.

Packer inflation shall be by hydraulic means only, using clean potable water from mains supply.

The Subcontractor shall report raw data from each packer test, including submission of the in-situ test sheet, to the RIZZO Field Team Leader on completion of the test.

Notwithstanding the particular requirements specified above, the Subcontractor shall submit his detailed proposals for undertaking packer tests for the RIZZO Field Team Leader's prior acceptance and approval.

### **2.3.6 Permeability Testing**

In-situ permeability testing of the superficial soils is to be carried out in accordance with BS 5930:1999 + A2:2010 and BS ISO 14686:2003.

The RIZZO Field Team Leader will confirm the requirement and the nature of the required test prior to the start of the borehole (e.g., slug testing, variable, constant, or falling head). The Subcontractor is to allow for provision of equipment suitable to complete any of the tests, including data loggers, electronic dip tape and pneumatic initiation system / valvage for



the delivery and control of compressed air. Repeat tests shall be undertaken as directed by the RIZZO Field Team Leader to ascertain mean permeability values.

Notwithstanding the particular requirements specified above, the Subcontractor shall submit his detailed proposals for undertaking permeability tests for the RIZZO Field Team Leader's prior acceptance and approval.

### **2.3.7 Pump Tests**

Where directed by the RIZZO Field Team Leader, the Subcontractor shall carry out pump tests in accordance with BSI BS 14686:2003 and BS EN ISO 22282 Part 4, 2012. The test will be performed on wells to estimate transmissivity and specific capacity.

The Subcontractor shall provide a test pump and all the accessory equipment, including power source and a submersible pump to execute the aquifer test. All equipment shall be reliable for all the period of pumping tests operation at the design rate.

Prior to the pump tests being carried out, in accordance with BSI BS 14686, monitoring data over a duration twice the length of the pump tests is required, e.g., for a 7-day test, 2 weeks of a minimum of daily records are required.

The discharge of the test pump will be measured by a discharge meter. A control valve shall be installed so that the discharge rate will not vary more than five percent from the average rate. Water levels shall be measured by an electrical or acoustic sounding device. The RIZZO Field Team Leader shall approve the equipment and installations.

The well construction will depend on conditions encountered including flow/ discharge rates. The Subcontractor shall obtain the RIZZO Field Team Leader's direction as appropriate of well construction and permit details including locations of discharge points, and secures the appropriate Permit to Work required to execute the Works.

Ground water samples will be taken during the pumping tests and a suitable 'tap' is required to be installed to enable the sampling. The frequency and amount of sampling will be determined prior to the tests by the RIZZO Field Team Leader.

The mode of operation of the test, the depth level of the pump and test yields will be as instructed by the RIZZO Field Team Leader.



During the test pumping the water discharged shall be piped to a point of surface drainage sufficiently far from the well to prevent a recharge effect.

A three-steps pumping test shall be executed. Each test is executed at a different pumping yield for 2 hours with 30 minutes recovery between each yield. The test yields are not fixed and will be directed by the RIZZO Field Team Leader according to characteristics of well and local conditions. The objective is to define the yield for a pumping test of 7 days.

A longer pumping test shall be performed with a pumping rate fixed during the three-steps pumping test. The well shall be pumped without any interruption at a constant rate for 7 days or 168 hours.

For each test the drawdown and recovery of the aquifer shall be measured. For both, the drawdown and the recovery, water-level measurements and the pumping yield should be recorded at the times indicated in *Table 2-3*.

The measure of the level should be preferably done using data logger equipment and controlled manually regularly during first 8 hours and twice a day minimum for next days including control of the pumped volume.

Measures are to be realised in pumping the well and in a number of standpipe installations (5 to 8) to be defined during fieldworks with the RIZZO Field Team Leader.

During the test the pumping yield must remain constant until completion of the test (equilibrium condition).

The recovery measurements shall be recorded until the dynamic water-level equals the static water-level of the aquifer or for a time fixed in accordance with the RIZZO Field Team Leader if it exceeds one third of pumping time.

### **2.3.8 Wireline Geophysics**

Wireline geophysical logging will be carried out following completion of the cored boreholes. This logging may comprise potentially a full suite including flow, formation temperature, density, salinity, caliper, natural gamma, fluid temperature/conductivity, salinity, resistivity, density, neutron porosity, flow logging, and optical borehole viewers.



A full suite of testing is proposed on all BH, DBH-W, and DBH boreholes dependent on the 'as found' stability of the borehole walls.

Caliper logging will be performed in all these boreholes prior to running the other logging tools. The results of this log will be passed immediately to the RIZZO Field Team Leader to assist in the choice of packer test zones.

The scenario to be adopted at each borehole location will be agreed with the RIZZO Field Team Leader subject to the ground conditions encountered during borehole advance.

Withdrawal of the temporary support employed during drilling shall minimise disturbance of the borehole wall at a constant rate using hydraulic equipment.

Flushing of completed boreholes with clean water or air mist shall be carried out prior to geophysical logging. This flushing shall be sufficiently controlled to prevent collapse or deterioration of the borehole walls.

Continuous profiling is required over the full depth of each borehole and the logging speed shall be selected to optimise data quality.

Optical televiewer surveys shall be carried out where directed by the RIZZO Field Team Leader. Prior to the survey the borehole shall be flushed out to remove material that may obscure the view of the borehole wall.

The optical televiewer must provide the following:

- Optical televiewer survey of 112.5 mm diameter exploratory vertical boreholes.
- Adequate lighting and lateral viewing capability to produce 360° colour image of the borehole wall with a vertical resolution of 1 mm.
- The survey shall be seen live on a Video Display Unit (VDU) monitor and shall provide an "unfolded," 360° colour image of the borehole wall. The 360° colour image of the borehole wall and the depth, inclination and azimuth of the televiewer shall be continuously recorded as a digital record.
- The televiewer survey system must enable the facility for recording general reference information at selected positions onto the digital record.



### **2.3.9 P-S Logging**

As an option, seismic suspension (P-S) logging may be performed in the boreholes designated by the RIZZO Field Team Leader in order to determine in-situ elastic modulus and small strain shear modulus value in a wide range of soils and rock. The compression and shear wave velocities are to be measured every meter in the borehole, except if otherwise stated by the RIZZO Field Team Leader.

The Subcontractor is to mobilise P-S suspension logging equipment with sufficient spare components for deployment in the designated boreholes.

The Subcontractor must satisfy himself of the applicability of his proposed equipment to the anticipated soil conditions and review the acquired data in the field.

### **2.4 PARTICULAR INSTRUMENTATION AND MONITORING REQUIREMENTS (SISG, SECTION 9, S1.14)**

The surface arrangement for instrumentation shall comprise a flush installation as shown in Drawing 2.1 of the SISG Specification for ground investigation as published by Thomas Telford, 1993. Appropriate raised lockable steel stopcock covers shall be used at each location.

Each installation should be flushed/ cleaned to remove the native silts and clays and drilling fluid residues. Proof of correct functionality of each monitoring installation by raising and lowering the water level shall be supplied to the RIZZO Field Team Leader within five business days of installation.

All slotted sections of standpipe installations shall have a seamless filter fabric ('geowrap' or 'geosock') to prevent sediment and small fines from clogging the well point.

A suitable granular filter shall be used within the response zone as instructed by the RIZZO Field Team Leader.

The grading of the filter pack material shall be selected by the Subcontractor and shall be submitted for the RIZZO Field Team Leader's approval.

Granular filter material and bentonite used for the impermeable seals shall be introduced uniformly and continuously to minimize or eliminate hydraulic segregation and bridging.



Monitoring of groundwater and gas will be on the instruction of the RIZZO Field Team Leader. All results shall be provided to the RIZZO Field Team Leader at regular intervals to be confirmed.

Warranties and/ or relevant manuals for all installations, materials, and equipment related to the installations are required to be provided by the Subcontractor.

Diver data loggers (CTD and Micro divers) are to be installed within selected installations/ wells following the development of each installation. The exact location and quantities of these locations will be confirmed by the RIZZO Field Team Leader.

## **2.5 PARTICULAR SAMPLING REQUIREMENTS (SISG, SECTION 7, S1.12)**

### **2.5.1 Preservation and Storage of Samples from Rotary Cores Scheduled for Laboratory Testing**

The Subcontractor shall provide the following equipment on Site to conform to the requirements of this Specification:

- A thermostatically-controlled wax bath capable of maintaining the wax at a temperature of approximately 65°C.
  - Low melting point wax, comprising 50 percent petrolatum and 50 percent paraffin wax (or similar approved).
  - Heavy-duty cling film and aluminum foil to the approval of the RIZZO Field Team Leader.
  - Two counter-rotating saws capable of cutting the plastic liner into two halves along its long axis.
  - Soil lathe for trimming the samples.
1. Each core run shall be handled with extreme care at all times.
  2. As soon as possible after recovery of the core run from the drill hole, the inner liner containing the core shall be taken without delay to the saw for cutting. The saw shall be set such that only the liner is cut, leaving the sample unscored. If necessary a liner-cutting implement (non-open bladed knife) may be used for final separation of the two halves of the liner, if the saw has not already penetrated the full thickness of the liner.



3. The sample, still in the two halves of the liner, shall be carried into the designated on-site logging area and placed on a clean flat work surface. The top half of the liner shall be removed carefully and any excess drilling fluid gently removed from the surface of the sample, using a clean dry cloth or absorbent paper towel. Gentle axial tapping at one end of the top half of the liner is permissible to ease removal. The sample shall then be rotated through 180 degrees, so that the other half of the liner can be removed and the remainder of the sample surface cleaned of drilling fluid.
4. Sub-sample locations shall be chosen in consultation with the RIZZO Field Team Leader without delay, avoiding any visible areas of drilling disturbance and, in cohesive materials, sand lenses, and seams. Samples of cohesive materials shall be cut from the core using either a wire or a sharp cutting blade to produce a sample approximately 300 mm long. The first cut shall be at the end of the sample nearest to the end of the core run in order to avoid unduly stressing the sample. Samples shall have the outer 5 mm of material carefully trimmed off in preparation for laboratory testing, using a soil lathe, before sealing. Samples of cohesionless materials shall be taken as agreed with the RIZZO Field Team Leader and will not require trimming. Samples of cohesionless materials that do not remain intact when handling should be collected in bag samples, noting the length of core that they originally occupied.
5. The preservation technique for samples is as follows: the entire sample shall be fully wrapped carefully in a single layer of aluminum foil with the shiny surface of the foil on the outside to dissipate the heat from the molten wax. The foil shall be carefully smoothed to remove any air pockets that may form between the sample and the aluminum foil. Care should be taken to avoid excess foil on the ends of the sample or the formation of air pockets. The sample shall be carefully covered (including its ends) with a smooth layer of low melting point wax. It may be necessary to coat the ends of the sample in wax as a separate action. The sample shall then be stood on its end on a flat clean surface to cool, maintaining its correct orientation.
6. When the wax has solidified, the sample shall be wrapped tightly in heavy-duty cling-film under tension, overlapping at least 30 mm on to both ends of the sample. Before using the cling film, it shall be dipped into the wax bath so that it is coated with a thin film of wax. Care should be taken to avoid the formation of air pockets. Each end of the sample shall then be wrapped tightly in heavy-duty cling-film. The cling film shall overlap at least 30 mm onto the curved surface of the sample. Before using the cling film, it shall be dipped into the wax bath so that it is coated with a thin film of wax.
7. The sample should then be dipped into the bath of low melting point wax and rotated until all the cling film (including that at the ends of the sample) is entirely covered in a second coat of wax. It may be necessary to dip the ends of the sample in wax as a separate action. The wax should then be allowed to cool.
8. When the wax on the surface of the sample has solidified, the sample shall be wrapped in a second layer of cling film dipped in wax, as described above. The cling film shall cover the curved surface and both ends of the sample. Any joins in the cling film shall overlap by at least 30 mm. Heavy duty adhesive tape shall then be wrapped around the bottom edges of both ends to protect the cling film from becoming damaged at these locations.





9. The sample shall be clearly identified on its outside with the following information: Contract number, borehole number, sample number and depth and with an arrow pointing to the top of the sample (and labelled as such). If a label is attached to the sample, it shall be secured beneath a further layer of tightly wrapped cling film. All marking shall be in indelible ink.
10. When the sample has been sealed as described above, it shall be protected from damage by laying it inside a protective 'sleeve' made from split drain pipe, guttering, or rigid liner. The sample shall be secured inside its protective sleeve by binding the package with adhesive tape. The sample shall be stored on-site in a temperature controlled environment that is free of vibrations. The Subcontractor takes all reasonable practicable measures to protect the core against all-weather extremities. Every attempt shall be made to prevent the temperature of the sample to drop below 5°C.
11. When transporting samples to the laboratory, the samples shall be handled with great care and shall be protected during the journey from vibration, sudden movement, and excessive changes in temperature or humidity. They shall not be transported in the core boxes but in a separate padded box to minimise sudden movement and vibration.
12. Samples shall be stored in the laboratory in a temperature and humidity controlled environment that is free of vibrations. The temperature shall be maintained between 10°C and 12°C and the relative humidity between 90 and 95%. Under no circumstances shall the temperature of the samples be allowed to drop below 5°C.
13. The Subcontractor may also be required to take small disturbed samples from the rotary cores, as instructed by the RIZZO Field Team Leader.

### **2.5.2 Preservation and Storage of Samples from Rotary Cores**

For cores not being used for laboratory testing, the following is required to be carried out for the long term preservation and storage of the core:

1. The split core liner is used to encase the core. It is then wrapped tightly in heavy-duty cling-film under tension, overlapping at least 30 mm on to both ends of the sample.
2. The core length should then be wrapped in bubble wrap.
3. The entire length of the core is then inserted into heavy duty 'lay flat' tubing or similar plastic sleeve. The plastic sleeve should be longer than the length of the core to provide sufficient excess to allow the ends to be twisted and taped.
4. Every effort should be made to remove any excess air from the lay flat tubing before sealing the ends.
5. The core should be returned into the correctly labelled core box in the correct orientation.



### **2.5.3 Sampling Frequency**

Sampling frequencies detailed below may be adjusted at any time as instructed by the RIZZO Field Team Leader.

The samples retained should be representative of the strata penetrated.

#### **2.5.3.1 Small disturbed samples**

These shall be taken at 1.0 m intervals in DBH, DBH-PZ, and DBH-W boreholes ensuring changes in formation and stratum are sampled. These samples shall weigh no less than 1 kg and can be collected in watertight bags.

#### **2.5.3.2 Continuous undisturbed sampling**

Continuous undisturbed sampling of soils and rock are required in the rotary cored triple core barrel boreholes with samples retrieved in a plastic liner. This is required for boreholes BH-Pz and BH boreholes.

#### **2.5.3.3 Core sub-sampling**

Sub-samples should be taken as described above unless otherwise instructed by the RIZZO Field Team Leader. On receipt of the core and after the liners have been split, the Subcontractor shall advise the RIZZO Field Team Leader that sampling is about to take place.

Once the core has been logged, sub-samples will be taken for testing. Care should be taken to ensure samples are suitable for the intended tests. Sub-samples will be required for geotechnical and radiological testing.

When sub-sampling core, care should be taken to sub-sample in a way that makes the most of the core for all the required testing i.e., not to provide samples for one test at the expense of the samples available for another test.

Top and bottom of sample should be clearly marked, including depths, borehole number, project number, and date.



### 2.5.3.4 SPT samples

The SPT samples should be extracted from the split spoon and placed in a plastic tub and clearly labelled with borehole name, depth range, and date.

**TABLE 2-1  
PROPOSED DRILLING SCOPE**

| WORKS                              |  |               | NUMBER OF LOCATIONS | METERS |
|------------------------------------|--|---------------|---------------------|--------|
| TYPE                               | DESCRIPTION  | DEPTH (m BGL) |                     |        |
| BH                                 | Deep rotary core boreholes, including continuous core sampling   | 150           | 4                   | 600    |
| BH-Pz <sup>1</sup>                 | Rotary core boreholes, including continuous core sampling and installation of piezometer                                 | 50            | 8                   | 400    |
| BHR-Pz <sup>1</sup>                | Boreholes with continuous sampling for intrusive ground radiological investigation, including installation of piezometer | 30            | 9                   | 270    |
| DBH-W <sup>1</sup><br>(pump wells) | Destructive borings for pumping wells  | 75            | 4                   | 300    |
| DBH-Pz <sup>1</sup>                | Destructive borings with installation of piezometer  | 75            | 30                  | 2,250  |
| PR                                 | Pressuremeter boring, with pressuremeter test carried out at 2 m intervals   | 50            | 13                  | 650    |
| SPT                                | Boreholes with Standard Penetration tests  | 30            | 10                  | 300    |
| DBH                                | Destructive borings  | 50            | 7                   | 350    |
| TOTAL                              |  |               | 85                  | 5,120  |

Notes:

<sup>1</sup>Include cost of well/piezometer installation (i.e. permanent casing, grouting, filter pack, screens)

**TABLE 2-2  
PROPOSED FIELD TESTS**

| IN-SITU TESTING QUANTITIES     |                  |
|--------------------------------|------------------|
| DESCRIPTION                    | QUANTITY         |
| Pumping Test                   | To be determined |
| Permeability Test              | To be determined |
| Packer Permeability Test       | To be determined |
| Pressuremeter Test             | To be determined |
| WIRELINE GEOPHYSICS QUANTITIES |                  |
| Flow                           | To be determined |
| Formation Temperature          | To be determined |
| Density                        | To be determined |
| Salinity                       | To be determined |
| Calliper                       | To be determined |
| Natural Gamma                  | To be determined |
| Fluid temperature/conductivity | To be determined |
| Resistivity                    | To be determined |
| Neutron Porosity               | To be determined |



|                                |                  |
|--------------------------------|------------------|
| Optical / Acoustic Televiewers | To be determined |
|--------------------------------|------------------|

**TABLE 2-3  
PUMP TEST RECORDS TIMING**

| <b>TIME SINCE PUMPING STARTED<br/>(STOPPED) IN MINUTES</b> | <b>TIME INTERVAL BETWEEN<br/>MEASUREMENTS IN MINUTES</b> |
|--|--|
| 0 -10  | 1  |
| 10 -20   | 2  |
| 20 – 60  | 5  |
| 60 – 120   | 30   |
| 120 – 1,440  | 60   |
| 1,440 - termination of test                                | 480 (8h)   |

## **2.6 BOREHOLE ABANDONMENT**

Once sampling, vertical deviation, and acoustic televiewer testing is completed, borings shall be backfilled using a clean, low permeability cement-bentonite grout mix. The cement-bentonite grout shall be placed from the bottom of each borehole to the ground surface by either pumping through a tremie pipe or use of bottom discharge through the drilling pipe. As grout is placed, the borehole casing shall be removed. The grout shall be terminated 4 m below ground surface (bgs). Twenty-four hours later, an impermeable 2 m thick plug/cap consisting of concrete grout should be added, to account for grout shrinkage, and the remaining 2 m void should be filled with soil cuttings. The boring location will be staked and flagged for the final survey.

## **2.7 DELIVERABLES**

### **2.7.1 Data Format**

To enable 3D visualisation of the subsurface by the hydrogeological modelling contractor appointed separately by RIZZO, the Subcontractor shall provide:

- All borehole logs and information in gINT format
- All site data in a format compatible with gOcad and DataMine

### **2.7.2 Borehole Logs**

Typed preliminary borehole logs should be provided in accordance with the Site Investigation in Construction: 3 Specification for Ground Investigation (SISG, 1993).



Borehole logs are to be provided to the RIZZO Field Team Leader as follows:

- Drillers logs: by 10:00 a.m. the following business day
- CP and RC logs: five business days following the completion of each drilling method

### **2.7.3 Drilling Parameter Recording**

Within two weeks after the completion of each borehole the Subcontractor will submit 2 copies of diagraphical measurements (graphical) with all recording of the following parameters:

- Thrust
- Torque
- Flush pressure
- Rotation Speed
- Drilling Rate

### **2.7.4 Pressuremeter Testing**

Daily records are required from the Subcontractor detailing the executed tests, stating encountered difficulties, achieved depths, measured resistance values, as well as any other significant information.

In addition, no later than two weeks after the completion of the pressuremeter drilling, the Subcontractor shall provide a provisional pressuremeter log giving the rectified values of  $E_M$  (Ménard deformation modulus) and  $p_l$  (limit pressure), as well as the diagrams showing the other characteristics and curves mentioned in the above paragraph.

All recorded, computed, and corrected values must be furnished in a digital format with the final report.

In addition, the Subcontractor shall provide a digital file compatible with Excel containing at least the following information:

- The test number
- The X, Y, and Z coordinates
- Time/ date of test



- Four columns table containing the test results (depth, Menard modulus  $E_m$ , limit pressure  $p_l$  and creep pressure  $p_c$ )
- The sectional drawing of the drilling with references and symbolic representations of the nature of the soils estimated

### 2.7.5 Standard Penetration Testing (SPT)

The borehole logs for the SPT boreholes are to include the depths and number of blows required to complete the test inclusive of the seating and for N values.

Daily records are required from the Subcontractor detailing the executed tests, stating encountered difficulties, achieved depths, measured resistance values or any other significant information.

No later than two weeks after the execution of each test, the Subcontractor shall submit a provisional report which is to include:

- The test number
- The time/ dates of starting and finishing the test
- The location on a map supplied by RIZZO or a plan relative to known and fixed points, in addition to the X, Y, and Z coordinates
- The level of the point from which depths are measured
- The characteristics of the equipment in use
- The location of strata changes
- Size of casing and depth of cased portion of boring
- Type sampler and length and inside diameter of barrels
- Sample depth and number, (if utilized)
- Description of soil
- Strata changes within sample
- Number of blows per 0.15 m
- The remarks noted in the daily report

A global report, including all test reports following the completion of the SPT boreholes and is to be handed over to the RIZZO Field Team Leader two weeks after completion of the Works on-site.

In addition, for each SPT boring the Subcontractor shall provide a digital file compatible with Excel containing at least the following information:





- The test number
- The X, Y, and Z coordinates
- Time/ date of test
- Water level
- A table containing the test results (depth and number of blows per 0.15m)

### **2.7.6 Boreholes for Intrusive Ground Radiological Investigation BHR-Pz**

Daily records are required from the Subcontractor detailing the work executed, stating difficulties encountered, the methods used, description of equipment and depth intervals used to take the soils samples.

When the borings are made, borehole logs shall be prepared and issued containing the date when the boring was made, the location of the boring, the depths of borings, and the elevations with respect to a permanent benchmark. The logs should also include the elevations of the top and bottom of borings and the elevations of the boundaries of soil or rock strata, as well as the level at which the water table was encountered.

In addition, the classification and description of soil and rock layers, percent recovery of rock core, quantity of core not recovered for each core interval or drill run, and rock quality designation (RQD) should be noted.

Results of field permeability tests and geophysical borehole logging should also be included on logs. The type of tools used in making the boring should be recorded. If the tools were changed, the depth at which the change was made and the reason for the change should be noted.

Notes should be provided of everything significant to the interpretation of subsurface conditions, such as incidents of settling or dropping of drill rods, abnormally low resistance to drilling or advance of samplers, core losses, or instability or heave of the side and bottom of boreholes.

Influx of groundwater, depths, and amounts of water or drilling mud losses, together with depths at which circulation is recovered, and any other special feature or occurrence should be recorded on boring logs and geological cross sections.





### **2.7.7 Monthly Reports**

The Subcontractor shall attend monthly Contract Meetings with the RIZZO Field Team Leader to report on Works progress. The RIZZO Field Team Leader and Subcontractor may request additional Site meetings where unforeseen/ unanticipated circumstances take place or problems arise, which could jeopardise the project's success. In these meetings, the Subcontractor shall report the unforeseen or unanticipated circumstances or problems, and propose measures to resolve the issues arising.

### **2.7.8 Pumping Test**

In case of performing pumping tests, no later than two weeks after the execution of each test, the Subcontractor shall submit a provisional report, which is to include:

Pumping test data shall be supplied to the RIZZO Field Team Leader from all pumping tests conducted on the well. These will show dates, water levels, discharge rates, times of stopping and starting the pump, and other conditions that could affect the test data, as well as the records of the in-situ test executed during the pumping test, with date and time references of the water samples.

## **2.8 SCHEDULE, FACILITIES, AND SITE CONSTRAINTS**

Work is expected to be performed in early fall 2014. A six-day per week working schedule (Monday through Saturday) is expected. Weather delays will be expected to be made up by working on Sundays, if needed. RIZZO's Field Team Leader will be in the field with the selected Subcontractor for the duration of the field work. Should weather conditions exist that require suspension of field activities or if equipment breakdowns occur, it must be agreed to in the field at that time by RIZZO, noted, and recorded.

Sanitary facilities and one site trailer will be provided by RIZZO.

The Subcontractor should develop the bid while keeping in mind the following constraints:

1. The site is adjacent to the Sellafield nuclear facility. Radiological testing using a Geiger counter will be required for samples extracted. If required, radiological testing will be performed by others. Radiological tests will give immediate results and should not affect sample packaging/handling time.
2. Very wet and/or muddy ground is likely during drilling, including low-lying flooded areas.



3. Part of the area is a working farm. Methods should be proposed to minimize impact on the crops, with respect to both damage and interference with normal farming activities.
4. Drilling locations may be on gentle slopes (< 10 degrees), but the Site is comprised of rolling hills with occasional surface water features.
5. The subcontractor shall be responsible for the removal of all equipment, instrumentation, and materials from the project areas following completion of field work. The subcontractor is also responsible for the restoration of the site to its previous condition. Repairs to public roads must be coordinated by the subcontractor directly with the local and/or highways authority. The subcontractor is responsible for maintaining the cleanliness of all roads approaching the site access throughout the execution of the works.
6. The subcontractor must arrange for washing all truck and vehicle tires prior to leaving the site, and shall permit use of the tire washing system for RIZZO and NuGen vehicles as well.
7. All subcontractor personnel must have identification documents to access the site. The Subcontractor must provide advanced notification of all people and vehicles known to be visiting the site during field work. When practical, all equipment must be returned to the secure storage area. Vehicles must remain 25 m from the Sellafield fence. All fuels, oils, chemicals, compressed gas cylinders, and other incendiary/flammable items must be secured in a suitably robust structure, under lock and key.
8. The Client Representative will be responsible for permitting.
9. Bidder must provide UK business licenses.

## **2.9 STAFFING**

See *Section 3.1* for Personnel Qualification and Staffing requirements.



### **3.0 QUALITY, HEALTH, SAFETY, AND ENVIRONMENTAL REQUIREMENTS**

The subcontractor must make all efforts to prevent unnecessary environmental impact (waste, noise, etc.). The Low Church Moss Environmental Protected Area must not be disturbed or trespassed during the drilling operations. No drilling is planned in this Protected Area, which is located outside the site boundary to the immediate northwest. Additionally, the subcontractor must comply with all applicable health, safety, and environmental legislation, including:

- Construction Design and Management Regulations 2007
- Occupational H&S Management Systems – Requirements
- ISO 14001 Environmental Management
- Management of Health and Safety at Work Regulations 1999
- Licensing Nuclear Installations
- Principals for a Strong Nuclear Safety Culture
- Workplace Health Safety Welfare Regulations 1992
- Environment Protection Act 1990
- Regulatory Reform (Fire Safety) order 2005
- The Health & Safety (First Aid) Regulations 1981
- Reporting of Injuries; Diseases and Dangerous Occurrence Regulations 2013
- HSE Five Steps to Risk Assessment
- Personal Protective Equipment at Work
- Provision and Use of Work Equipment Regulations 1998
- Lifting Operations and Lifting Equipment Regulations 1998
- Manual Handling Operations Regulations 1992
- Control of Substances Hazardous to Health Regulations 2002
- Memorandum of Guidance Electricity at Work Regulations 1989
- Pressure Systems Safety Regulations 2000
- Work at Height Regulations 2005
- Confined Spaces
- Noise at Work
- The Control of Vibration at Work Regulations 2005



Drilling and sampling will be performed under the RIZZO Quality, Health, Safety, and Environmental (QHSE) Management System. Subcontractors used by RIZZO for the work described in this Specification will be approved per the RIZZO QHSE Management System.

The Subcontractor will work under the RIZZO QHSE Management System. This will require some training for staff, as well as additional controls on procedures, equipment, and reporting, as outlined below.

### **3.1 PERSONNEL QUALIFICATIONS**

The Subcontractor shall provide resumes for all personnel. Subcontractor will provide licenses, registrations, etc., as applicable for project staff.

Lead drillers must have at least five years of relevant experience as documented on the resume.

Test results or capability demonstrations are required for drillers, personnel performing the vertical deviation survey, and personnel performing the acoustic televiwer testing. This can consist of a letter from Subcontractor senior staff or management attesting to personnel capability. Alternatively, RIZZO can observe a “test run” immediately prior to actual drilling, vertical deviation surveying, and/or acoustic televiwer testing to achieve this requirement.

There are no qualification requirements for helpers.

The Subcontractor is to provide a full-time, dedicated Health, Safety, and Environmental (HSE) professional with responsibility for HSE for the Subcontractor’s work. The HSE professional must have successfully completed the Construction Industry Training Board (CITB) Site Management Safety Training Scheme and have a minimum of two years of relevant experience.

The Subcontractor is to provide a qualified geologist or engineer to log and describe the soil/rock samples. One geologist or engineer per rig is required.

Provide resumes of staff to supervise drill rigs and perform borehole logging. Personnel for this task must meet the following requirements:

- University degree in engineering, geology, or related field
- Minimum two years of experience



Training on the RIZZO Work Plan and the RIZZO QHSE Plan is required for all involved Subcontractor staff. Training will occur on the job site prior to the beginning of drilling and will take no more than two hours.



## **4.0 SUBMITTALS**

### **4.1 PROPOSAL SUBMITTALS**

The following items are required to be submitted with the Proposal.

#### **4.1.1 Logistics/Plan**

The Subcontractor must identify in the Proposal any potential site conditions/logistics and a plan for accomplishing the required work, with consideration to minimizing both damage to the crops and interference with normal farming activities.

Restoration of damage to the Site is included within the required scope of work. With the proposal, Subcontractor must supply a plan for restoration.

#### **4.1.2 Health, Safety, and Environmental**

Provide a Health, Safety, and Environmental Plan for the scope of work.

#### **4.1.3 Personnel Qualifications**

The Subcontractor shall furnish adequately trained, experienced key personnel to efficiently perform the work at all times. Submit resumes for all personnel, as well as any applicable licenses, registrations, etc., for project staff. Qualification requirements are outlined in *Section 3.1*.

#### **4.1.4 Drilling Equipment, Procedures, and Materials**

List drill rigs and other equipment expected to be used.

List drilling procedure(s) to be used. If nationally recognized standards (BS, ASTM, or similar) are not used, provide written procedures for approval and inclusion in the RIZZO Work Plan.

Provide a brief description of the means, methods, and materials to be used for drilling.



The Subcontractor may suggest alternative drilling methods for use. Provide a description of the alternative method(s) to be used and explain the cost and schedule impact. Describe how requirements will be met.

#### **4.1.5 Duration**

Provide estimates for the following:

1. Number of Calendar Days Required for Mobilisation to the Field upon Notice to Proceed
2. Number of Calendar Days in the Field for each investigation type
3. Number of Calendar Days for Report Preparation
4. Number of days per week and hours per day on which the bid is based
5. Number and type of field and office staff that will be working on this project

#### **4.1.6 Previous Experience**

Describe similar work the Subcontractor has conducted.

Describe any previous experience with nuclear quality assurance (such as NQA-1) work, if any, or any current quality system accreditations (ISO or similar).

#### **4.1.7 Subcontractors/Teaming**

If you intend to use subcontractors or team with other firms to complete this work, please specify which firm(s) and for what purpose. Subcontractors based in the local Copeland area, or in the Cumbria region, are strongly preferred.

#### **4.1.8 Bill of Quantities**

Provide a Bill of Quantities according to *Table 2-1 and Table 2-2*. For quantities yet to be determined, provide unit cost.

### **4.2 IN-PROCESS SUBMITTALS**

The following submittals are required during the performance of work and may be the basis for milestone payments.



#### **4.2.1 Daily and Weekly Updates**

RIZZO is required to provide weekly progress updates to the Client and will require information from the Subcontractor to provide these. For these updates, RIZZO will require the following information from the Subcontractor:

1. Work completed to date
2. Upcoming work and schedule
3. Personnel on site
4. Summary of HSE incidents (if any), methods to evaluate, and resolution

In addition, RIZZO and the Subcontractor will meet daily to agree on work accomplished, schedule maintenance, and recovery plans to maintain schedule (if necessary).

#### **4.3 FINAL SUBMITTALS**

The following items will be required following the conclusion of the field work and prior to final payment.

##### **4.3.1 Records and Boring Logs**

Submit final records of on-site work, boring logs, photographs, and all associated documentation. The Subcontractor shall keep records in hard copy and electronic versions. The Subcontractor and RIZZO shall reconcile their records daily to ensure that both parties are in agreement with payment quantities and recorded specifics of that day's work.

##### **4.3.2 Final Completion Report**

The final completion report shall contain all the boring logs and recorded data. The final completion report shall be given to RIZZO in both electronic and hard copy formats within two weeks of completion of field work. RIZZO will provide storage of boring log records in accordance with its nuclear quality assurance program.

Final payment will not be made until both RIZZO and the Client accept the work of the Subcontractor, including the final completion report.





# **EXHIBIT 1**

## **PROPOSED SITE INVESTIGATION**



**ATTACHMENT B**  
**CONTRACT AND INSURANCE**  
**REQUIREMENTS**



# AGREEMENT FOR DRILLING WORK SERVICES

**THIS AGREEMENT**, effective as of this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, is by and between  
RIZZO Associates (“Consultant”)  
and \_\_\_\_\_ (“Driller”).

**THE PROJECT** is generally described as:

Destructive and sampling drilling of boreholes, including provision of labor, equipment, and materials.  
and is located at the Moorside Site in Cumbria, United Kingdom (“Project Site”).

**THIS AGREEMENT** consists of the following documents which are incorporated herein by reference:

- GENERAL CONDITIONS FOR THE ABOVE MENTIONED AGREEMENT; and
- Driller’s SCOPE OF WORK AND SCHEDULE OF CHARGES (Exhibit A);
- Any TASK ORDERS under this Agreement; and
- Any documents specifically listed below or incorporated by reference in the listed documents.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Driller agrees to perform the Work set forth in this Agreement and in accordance with its terms, including all attachments incorporated herein by reference. This Agreement may not be modified or altered, except in writing as specifically described in this Agreement.

**CONSULTANT:**

**DRILLER:**

|                    |  |  |
|--------------------|--|--|
| <b>Signature:</b>  |  |  |
| <b>Print Name:</b> |  |  |
| <b>Title:</b>      |  |  |
| <b>Company:</b>    |  |  |
| <b>Address:</b>    |  |  |
|                    |  |  |
| <b>Date:</b>       |  |  |

# GENERAL CONDITIONS FOR DRILLING WORK SERVICES

## 1. DEFINITIONS

**1.1 Client:** Person, entity or organization for which Consultant is rendering services regarding the Project.

**1.2. Consulting Agreement:** Agreement between Client and Consultant regarding services rendered by Consultant to Client regarding the Project.

**1.3. Day(s).** Calendar day(s) unless otherwise stated.

**1.4. Hazardous Materials.** The term Hazardous Materials means any toxic substances, chemicals, radioactivity, pollutants or other materials, in whatever form or state, known or suspected to impair the environment in any way whatsoever. Hazardous Materials include, but are not limited to, those substances defined, designated or listed in any UK or local law, regulation or ordinance concerning hazardous wastes, toxic substances or pollution.

**1.5. Task Order:** A written agreement executed by Consultant and Driller that describes a specific task to be performed by Driller in accordance with this Agreement. A Task Order designates the Work to be performed, the time of performance, and the compensation due for successful completion of the task. The terms and conditions of this Agreement supersede any terms and conditions contained in the Task Order, unless the Task Order specifically references a term or condition of this Agreement and states that such term or condition is superseded or modified.

**1.6. Work.** The services and other work performed by Driller, as set forth in this Agreement, the SCOPE OF WORK, and any Task Order.

## 2. INCORPORATION OF CONSULTING AGREEMENT

The Consulting Agreement is either attached to this Agreement as an exhibit or, if not attached, will be made available to Driller upon written request. The Consulting Agreement is incorporated

herein and is binding upon Driller to the following extent:

**2.1. Standards of Performance.** Driller will perform its Work in accordance with any standard of performance, representation, guarantee or warranty applicable to Consultant under the Consulting Agreement. Consultant may enforce any such representation, guarantee or warranty against Driller to the same extent that Client may enforce such representation, guarantee or warranty against Consultant.

**2.2. Scope of Work.** Unless otherwise agreed in writing, Driller is responsible for the same breadth of Work as required of Consultant by the Consulting Agreement to the extent applicable to Driller's scope of Work.

**2.3. Dispute Resolution.** Driller agrees to participate in, and be bound by, any dispute resolution procedure contained in the Consulting Agreement, including arbitration, if applicable.

**2.4. Payment Provisions.** Consultant may enforce against Driller any payment provisions applicable to Consultant, including, but not limited to, retainages, withhold rights, offset rights and audit rights.

**2.5. Indemnification.** If Consultant has agreed to indemnify, Client, Driller agrees to defend, indemnify and hold harmless Consultant from any and all claims, damages or liability arising under the indemnification agreement between Consultant and Client that arise out of or relate to the performance or non-performance of Driller.

**2.6. Ownership & Use of Documents.** To the extent that any provisions of the Consulting Agreement governing the ownership and use of documents conflict with the provisions of this Agreement, the provisions of the Consulting Agreement take precedence over the terms contained herein.

**2.7. Precedence.** In the event that incorporated provisions from the Consulting Agreement conflict

with provisions in this Agreement, the most stringent provisions apply.

### **3. SCOPE OF WORK**

Driller represents that it is a specialist in the type of Work to be performed under this Agreement and will perform it in accordance with the professional standards prevailing at the time of performance, including all applicable industry and trade standards, standards published by Consultant and Client, and all applicable UK and local regulations, ordinances and statutes. Driller will begin Work only after receipt of a fully-executed Task Order.

**3.1. Changes in Scope.** Consultant may order changes in the Work performed by Driller including, but not limited to, additional Work, changes in Work scope, changes in schedule and time of completion, and changes in deliverables or form of deliverables. Neither time of performance nor compensation will be increased except by written agreement (as provided in Section 14) prior to the performance of the changed Work.

**3.1.1. Request & Proposal.** If Consultant requires changes, it will request that Driller provide a written proposal to perform the changed Work, including a description of the Work to be performed or deleted and a statement of any increase or decrease in time of performance or Driller's compensation.

**3.1.2. Amendment.** Driller and Consultant agree to negotiate in good faith for changes to the Work. If they agree on the changed Work, they will execute a written amendment for the change. Unless the amendment specifically states otherwise, all Work performed under it will be subject to this Agreement. If Driller and Consultant cannot agree upon the terms for an amendment, the difference between Consultant's estimates and the terms of Driller's offer to perform the Work will constitute a dispute for resolution under Section 13, "Disputes." Consultant will pay all undisputed amounts due and Driller will perform all Work required by the change pending resolution of the dispute.

**3.2. Time.** Time is of the essence in Driller's performance of this Agreement and each Task Order.

**3.3. Licenses.** Driller will procure and maintain business and professional licenses and registrations necessary to provide its Work.

### **4. PAYMENTS TO DRILLER**

All Work performed under this Agreement, except as expressly identified otherwise in the attached SCOPE OF WORK and the Task Orders will be provided on a time and materials basis. Driller's rates are set forth in the SCHEDULE OF CHARGES.

**4.1. Invoices.** No payment will become due until after Consultant receives an invoice in a format acceptable to Consultant and with adequate supporting documentation. If Consultant disputes any portion of an invoice, Consultant will advise Driller in writing and pay the undisputed portion of the invoice. Consultant and Driller agree to resolve the disputed portion of any invoice through the procedures outlined in Section 13, "Disputes" of this Agreement.

**4.2. Payments.** Within 10 business days after Consultant receives payment from Client for the Work covered by Driller's invoice, Consultant will pay Driller's invoices that are due. However, provision of certificates of insurance required under this Agreement is a precondition to any payment to Driller.

**4.3. Final Payment.** Final payment is due only after Driller fully and satisfactorily completes the Work. Consultant may, at its sole option and discretion, require Driller to submit evidence satisfactory to Consultant that all payrolls, material and equipment bills, and all known indebtedness connected with Driller's Work have been satisfied and paid before issuing final payment.

### **5. INDEPENDENT CONTRACTOR**

Driller will perform Work under this Agreement as an independent contractor, and its employees will at all times be under its sole discretion and control. Driller will select the means, manner and method of completing Work, without detail, control, or direction from Consultant.

## 6. HEALTH & SAFETY

Driller is solely responsible for its activities and the health and safety of persons and property at the Project site during the period of Work by Driller. Neither the professional activities nor the presence of Consultant, its Subconsultants, or their employees at the jobsite constitutes control by Consultant over the operations of Driller, its employees, or its agents. Nothing contained in this Section diminishes, alters, or otherwise affects the indemnification requirements contained elsewhere in this Agreement.

**6.1. Safety Precautions.** Driller will supply barricades, flagmen and traffic control as necessary for its operations in public areas of streets.

**6.2. Hazardous Materials.** If Driller will be working on a site where Hazardous Materials exist, it will arrange appropriate safety and health training at its own expense for all of its employees who may come in contact with such materials. Such training must, at a minimum, conform to the requirements of the UK Construction Design and Management (CDM) requirements, latest edition, and Driller will have available proof of course completion for each employee working at a Hazardous Materials site before permitting the employee to enter the site for any purpose.

**6.3. Protection of Employees.** Driller is responsible for providing, at its own expense, all personal protective clothing and equipment required for its employees to perform their Work in a safe manner and in compliance with all applicable UK and local laws and regulations including, but not limited to the UK CDM requirements, latest edition. Driller is responsible for ensuring that such equipment is in good condition and is properly inspected and maintained. If Consultant or Client has prepared or adopted a Job Safety Plan, Driller must, at a minimum, use the equipment and follow the procedures described in that plan. These requirements do not relieve Driller of the responsibility to provide equipment and institute procedures affording a greater degree of protection than those specified in the Job Safety Plan, if such equipment and procedures are

necessary for Driller to perform its tasks in a safe manner and in compliance with applicable local and UK regulations.

## 7. AFFIRMATIVE ACTION AND EQUAL EMPLOYMENT OPPORTUNITY

Driller is responsible for complying with all UK and local regulations regarding affirmative action and equal employment opportunity.

## 8. SITE CONDITIONS

**8.1. Subsurface Conditions and Utilities.** Driller is solely responsible for determining the type and location of all underground and overhead utilities that may be present. Determination includes, but is not limited to, contacting all utilities, governmental agencies, underground excavation notification agencies, or other parties that may own, control or have information regarding underground utilities or other subsurface obstructions. Prior to making any such contact, however, Driller will obtain from Consultant written authorization to make those contacts, as prior contacts may have already been completed. Driller will not drill or excavate until it has determined that the drilling or excavation will not damage, undermine, destroy or otherwise impair any utility, pipeline, conduit, cable or other structure.

**8.2. Site Conditions.** Driller will inspect the site and satisfy itself as to conditions on the site that may affect the Work before commencing Work. Driller will notify Consultant in writing if it discovers conditions or circumstances while performing the Work that it had not contemplated at the commencement of this Agreement and which were not reasonably discoverable from a site inspection prior to commencing Work ("Changed Conditions"). Consultant and Driller agree that they will then renegotiate in good faith the terms and conditions of this Agreement, and, if they cannot agree upon amended terms and conditions within 30 days after notice, Consultant may terminate this Agreement and compensated Driller as set forth in Section 12, "Termination."

**8.3. Site Restoration.** Prior to completion of its Work, Driller will backfill, cover, fence, lock and take any other necessary precautions to prevent

injury to persons or property caused by the Work, in accordance with requirements provided by Consultant and Client.

## 9. INDEMNIFICATION

**9.1. Indemnity.** Driller will defend, indemnify and hold harmless Consultant and Client, their respective officers, directors, shareholders and employees (collectively "Indemnitees") from and against any and all claims, demands, causes of action, damages, or liabilities, including attorney's fees and costs of defense, that arise from or are alleged to arise from any acts, errors, omissions or breaches of this Agreement by Driller, its agents, officers, employees or subcontractors. Driller also agrees to defend, indemnify, and hold harmless Indemnitees from and against any and all claims for payment, liens or other encumbrances recorded against real property, asserted or filed by Driller, or by any person or entity hired by Driller. The obligation of Driller to defend, indemnify and hold harmless apply separately to each Indemnitee, and the acts, errors or omissions of any Indemnitee will not be attributed to any other Indemnitee.

**9.2. Continuing Agreement.** The indemnity obligations established under this Agreement will survive the expiration or termination of this Agreement. If Driller provides Work to Consultant that the parties do not confirm through execution of an amendment to this Agreement, the obligations of Driller to defend, indemnify and hold harmless apply to such Work as if the parties had executed an amendment.

## 10. INSURANCE

**10.1. Driller's Insurance.** Driller will maintain the following insurance for the term of this Agreement and, for any claims-made policies of insurance, for a minimum of 5 years following completion of the Project:

**10.1.1. Workers' Compensation; Employer's Liability.** Insurance as prescribed by applicable law, and Employer's Liability policy with a limit of not less than £600,000.

**10.1.2. Commercial General Liability.** Insurance with a combined single limit of £600,000, naming Consultant and Client as

additional insureds under the policy. The policy must include a cross-liability endorsement; blanket contractual liability and broad-form property damage coverage; underground, explosion and collapse hazard coverage; products and completed operations coverage; and provide primary coverage for all additional insureds.

**10.1.3. Automobile Liability.** Insurance covering liability for all owned, hired and non-owned vehicles with minimum limits of £600,000 for bodily injury per person, £600,000 property damage and £600,000 combined single limit per occurrence, and naming Consultant and Client as additional insureds under the policy.

**10.1.4. Pollution Liability.** Insurance covering claims and response costs for actual or threatened environmental impairment losses resulting from the acts, errors and omissions of Subconsultant in amounts of not less than £600,000 per occurrence and naming Consultant and Client as additional insureds under the policy.

Check and initial if Pollution Liability Insurance is NOT required. \_\_\_\_\_|\_\_\_\_\_

**10.2. Certificates of Insurance.** Before commencing to provide Work under this Agreement, Driller will provide Consultant with certificate(s) of insurance evidencing the existence of the policies required herein from companies having an A.M. Best's rating of at least "A:VIII." All certificates must provide for 30-days advance notice to Consultant of any material change in the policy or coverage, and a waiver of subrogation.

## 11. DOCUMENTS & INFORMATION; CONFIDENTIALITY

**11.1. Consultant and Client Documents.** All documents provided by Consultant and/or Client will remain the property of the party that provides them. Driller will return all such documents to Consultant upon completion of its Work, or immediately upon request.

**11.2. Confidentiality.** All documents, reports, disclosures, plans and other information of every nature and description obtained by Driller in the performance of Work hereunder will be strictly confidential and may not be used for the benefit of Driller or any affiliate, subsidiary or parent



organization of Driller, or disclosed to any third party, either during Driller's employment or after termination of this Agreement, except as may be necessary in order to perform Work pursuant to this Agreement.

## **12. SUSPENSION AND DELAY**

**12.1. Procedures.** Consultant may, at any time and by 5 days written notice, suspend performance of all or any part of the Work by Driller. Driller may terminate this Agreement if Consultant suspends Driller's Work for more than 180 days and Consultant will pay Driller as set forth under Section 12, "Termination." If Consultant suspends Driller's field or technical Work, or delays occur due to causes not under Driller's control, Consultant and Driller agree to equitably adjust the time for completion of the Work and Driller's compensation for any necessary demobilization and subsequent remobilization.

**12.2. Force Majeure.** Neither Consultant nor Driller will be liable for failure to perform Work provided for in this Agreement when such performance is hindered or prevented by an occurrence beyond the control and without the fault or negligence of either Consultant or Driller.

## **13. TERMINATION**

**13.1. Termination for Convenience.** Consultant may terminate this Agreement for its convenience in whole or in part at any time upon 5 days written notice delivered or mailed to Driller. Such notice will state the extent and date on which Driller must: stop all Work and place no further orders or subcontracts; terminate all outstanding Work orders and subcontracts; take any necessary action to protect property in its possession in which Consultant and/or Client have or may acquire an interest; and take any other action that Consultant may direct. Consultant will reimburse Driller for Work satisfactorily performed prior to the termination, but the total amount paid to Driller shall not exceed the total contract price.

**13.2. Termination for Cause.** If Consultant determines in its sole discretion that Driller is in material breach of any obligation under this Agreement, Consultant may require that Driller remedy such breach within 3 days after receipt of

written notice from Consultant. If Driller fails to cure the breach or provide evidence satisfactory to Consultant that it will cure the breach, Consultant may terminate this Agreement and complete the Work by whatever method Consultant in its sole discretion deems expedient, including employing another driller to re-perform or complete the Work. Consultant will deduct the expense of re-performing or completing any terminated Work from amounts due Driller; and if such expense exceeds the sum otherwise payable under this Agreement, Driller will pay Consultant the amount that such expense exceeds the remaining amounts due Driller.

## **14. DISPUTES**

**14.1. Mediation.** All disputes between Driller and Consultant are subject to mediation. Either party may demand mediation by serving a written notice stating the nature of the dispute, amount of time or money claimed, and requiring that the matter be mediated within 90 days. The mediation will be administered under the laws of England and Wales, or by such other person or organization as the parties may agree upon.

**14.2. Precondition to Other Action.** No action or suit may be commenced unless mediation does not occur within 90 days after service of notice; or mediation occurs, but does not resolve the dispute; or a statute of limitation would elapse prior to 90 days after service of notice.

**14.3. Choice of Law; Venue.** This Agreement will be construed in accordance with and governed by the laws of England and Wales. Unless the parties agree otherwise, any mediation or other legal proceeding will occur in England.

## **15. NON-CIRCUMVENTION**

The Parties hereby agree, jointly, individually and mutually, not to circumvent or bypass each other in any manner to reach or communicate with the owners, principals or financiers of any given project, without explicit approval of both Parties.

## **16. MISCELLANEOUS**

**16.1. Integration and Severability.** This Agreement reflects the entire agreement of the parties with respect to its terms and supersedes all



prior agreements, whether written or oral. If any portion of this Agreement is found to be void or voidable, such portion will be deemed stricken and the Agreement reformed to as closely approximate the stricken portions as the law allows.

**16.2. Modification of this Agreement.** This Agreement may not be modified or altered, except by a written agreement signed by authorized representatives of both parties and referring specifically to this Agreement.

**16.3. Notices.** Any and all notices, requests, instructions, or other communications given by either party to the other must be in writing and either hand delivered to the recipient, or delivered by first-class mail (postage prepaid) or express mail (billed to sender) at the addresses given in this Agreement.

**16.4. Headings.** The headings used in this Agreement are for convenience only, and are not a part of this Agreement.

**16.5. Assignment.** Neither party may assign this Agreement, in whole or in part, without the prior written consent of the other party, except that Consultant may assign this Agreement to Client without Driller's consent.

**16.6 Waiver.** The waiver of any term, condition or breach of this Agreement will not operate as a subsequent waiver of the same term, condition, or breach.

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***End of General Conditions***

