

Waste Management Plan for the management of extractive waste, not including a waste facility, generated from onshore oil and gas prospecting activities including drilling, coring, leak off testing (LOT), acid wash and decommissioning but excluding any well stimulation or hydraulic fracturing (using oil and water based drilling mud)

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## **1. Introduction**

The process of prospective drilling, coring, formation testing and well decommissioning but without well stimulation or development as part of hydrocarbon prospecting operations will generate extractive waste.

The management of extractive waste falls within the scope of the Mining Waste Directive (MWD) 2006/21/EC. The management of extractive waste whether or not it involves a waste facility is a regulated activity and requires a permit under the Environmental Permitting (England and Wales) Regulations 2016.

This document is the Waste Management Plan to accompany the Standard rules permit SR2015 No.1 to comply with Article 5 of the MWD and ensure that the Article 4 objectives are met.

## **2. Operations and Facility Classification**

Operations on site will be limited to the management of extractive waste from prospecting for hydrocarbon mineral resources including the use of acid wash and formation pressure testing through the following activities:

- Drill and core
- Leak Off Test (LOT)
- Acid wash
- Well decommissioning

There will be no production activities. Well stimulation of any kind, including hydraulic fracturing, will not be carried out.

Extractive wastes will be generated by the drilling and associated processes of constructing and testing of a borehole to take samples, suspension and the subsequent decommissioning of the borehole only. This will include extractive waste generated by open-hole drilling at diameters which decrease with increasing depth after each well casing has been set.

As operations on site will not include any form of well stimulation, there will be no management of waste generated by such an activity. The extractive wastes which may be managed are:

- Spent drilling mud
- Drill cuttings
- Hydrocarbons
- Spent spacer fluid
- Spent suspension fluid
- Waste fluids from Leak Off Testing
- Acid wash flush fluids
- Produced and or Formation water

There will be no treatment or disposal of extractive wastes on the site surface other than the integral process of screening and separation of drill cuttings, spacer fluids, drilling fluids and mud.

### **The Drilling Process**

The drilling process will employ active mud management systems whereby drilling mud is circulated down through the drill pipe and back up the well bore, maintaining hydrostatic pressure (primary well control). Fully enclosed loop systems will be used for oil based drilling muds. Partially closed loop systems, which allow continuous fluid level management, will be used for water based drilling mud. The drilling muds

will transport the cuttings created by drilling the well-bore back to the surface, supporting the well bore and cooling the drill bit.

The drill cuttings are pieces of rock removed from the wellbore by the drill bit. These cuttings are transported back to surface within the drilling mud and separated at the surface by mud control equipment including mud cleaners, “shakers” and centrifuges.

### **The base drilling fluid**

In all cases a water based drilling mud will be used when drilling through aquifers. Water based drilling muds will be used at all other times unless it is not reasonably practicable to use water based muds due to the need to ensure the safety and stability of the well. In all cases the drilling muds used will be limited to those listed in Annex 1.

### **Water based drilling muds (WBDM)**

Water based drilling muds will be passed through shaker screens to remove drill cuttings and then into tanks for recirculation as part of a loop system. Water in these muds will react with clay minerals adding fine dispersed solids to the returning drill mud. Water is added during the process to dilute these solids and centrifuges used to reduce the solids content. However there will be a point at which the level of solids by volume results in the mud no longer providing suitable conditions for use and it becomes spent and replaced by a fresh mud. At that point the spent drilling mud will be extractive waste.

The drill cuttings will be separated on top of the shaker screens then transferred into skips as part of the process of being collected for transportation off site. The waste cuttings and muds will be separately characterised and taken off site for recycling or recovery by an authorised waste contractor to an appropriately authorised waste management facility as soon as it is reasonably practicable to do so.

Cuttings which have picked up hydrocarbon contamination which are properly characterised as hazardous waste will be centrifuged as well as put through the shaker and will be transported in covered skips. These will be collected and then transported off site to an authorised hazardous waste facility as soon as reasonably practicable. Drill cuttings that are hazardous waste will not be mixed with non-hazardous waste.

### **Oil based drilling muds (OBDM)**

OBDM will pass through the shaker screens and from the centrifuge(s) into tanks as part of the closed loop system. This will be recirculated as the drilling process progresses through to completion, reducing the amount of drilling mud used and reducing the quantity of waste produced. At the end of the process all possible oil

based drilling muds will be returned to the supplier for re-use as a non waste material.

The drill cuttings will be separated on top of the screens then transferred into skips as part of the process of collection and transportation off site. The waste cuttings and muds will be separately characterised and taken off site for recycling or recovery by authorised waste contractor to an appropriately authorised waste management facility.

Cuttings which are contaminated with OBDM, or have hydrocarbon contamination which are properly characterised as hazardous waste will be centrifuged as well as put through the shaker and will be transported in covered skips. These will be stored securely and transported off site to an authorised hazardous waste site as soon as reasonably practicable once collected. Drill cuttings that are hazardous waste will not be mixed with non-hazardous waste.

OBDM will not be used in geological formations which have sufficient porosity and permeability to allow a significant flow of groundwater, for example, chalk aquifers.

### **Removal of drilling mud**

Drilling mud will be displaced from the wellbore by a non-hazardous aqueous spacer fluid followed by a continuous column of cement slurry to ensure a high quality integral seal between the casing and the rock formation. The displaced drilling mud and spacer fluid will be returned to the surface for reuse wherever possible or be disposed of as extractive waste.

The amount of fluid within the mud management system will be continually monitored to assess for any losses or gains. Losses will be minimised and controlled through the use of non-hazardous filter cake medium and lost circulation materials to ensure that all possible precautions have been taken to minimise both losses or gains and maintain control of the well.

### **Cementing the well casing**

During the process of drilling, a series of steel casings will be installed within the wellbore and cemented in place to protect groundwater and maintain well integrity. The casing and cement sealing will be suitably designed, installed and tested to demonstrate that this provides protection of groundwater and other permeable zones.

Once the well bore and casing have been conditioned the cement will be pumped in slurry form down the inside of the cement stringer and cementing shoe and will rise up through the annular space between the drilled hole and the casing; once in place it will set hard.

Where casings are run through groundwater bearing formations once the casing has been cemented and allowed to set, a cement evaluation log will be run to confirm the integrity of the cement. All cement evaluation logs and down hole testing for each section of the borehole and for the entire length of the cemented sections will be retained at least until the well decommissioning and re-instatement process is complete. They will be made available for inspection by an authorised officer of the Environment Agency, if requested.

## **Wastes generated during the drilling process**

The drilling process will generate drill cuttings as described above. All drill cuttings separated from the drilling mud will be collected in skips and taken offsite as soon as reasonably practicable for recycling or recovery through an authorised waste management facility. Records are to be maintained of the quantities of drill cuttings and their characterisation for at least 2 years.

Drill cuttings and oil based drilling mud will be treated through mud controls to maximise the amount of oil based mud that can be returned to the closed loop system.

## **Protection of groundwater**

Drilling activities will be designed to ensure that there are no inputs of pollutants to groundwater and be carried out in accordance with the following:

- Drilling will comply with good practice for drilling water wells, as described in the Environment Agency's [Guidance on the design and installation of groundwater quality monitoring points \(Science Report SC020093\)](#).
- Drilling will not take place within source protection zones (SPZ) 1 or 2, as defined in the Environment Agency's [Groundwater protection: principles and practice](#) (see pages 23-24).
- Drilling fluids will be used in accordance with good practice as described in the Health and Safety Executive (HSE)'s guidance on 'The Offshore Installations and Wells (Design and Construction etc) Regulations 1996' (DCR), in particular that they will be designed to prevent exchange of fluids between the borehole and any groundwater-bearing formation; and Borehole Sites Operations Regulations 1995 BSOR.
- Drilling fluids will exclude hazardous substances as defined in paragraph 4 of Schedule 22 to the EPR 2010 and [guidance](#) published by the Joint Agencies Groundwater Directive Advisory Group (JAGDAG).
- In the case of principal and secondary aquifers (for which 'groundwater bodies' are defined for the purposes of the Water Framework Directive), air flush, water only or water-based fluids will be used.
- Acceptable additives are listed in Annex 1.
- If karstic or highly fissured conditions are anticipated, the operator will gain the Environment Agency's agreement to use of any additives other than inert

materials. In the event that there is a loss of circulation during drilling the operator will use only those materials listed in Annex 2 to manage the loss of circulation and will inform the Environment Agency as soon as practicable.

- Casing will be set and keyed into the low permeability formation beneath the groundwater body once that formation is reached, in accordance with good drilling and casing installation practice, as described in HSE's 'The Offshore Installations and Wells (Design and Construction etc) Regulations 1996' guidance. The maximum depth defined for a groundwater body is taken to be 400m; where the formation that contains a groundwater body extends below this, the criteria described above for protecting groundwater shall apply to the use of drilling fluids, until a low permeability formation is reached into which casing can be set.
- Measures will be taken when decommissioning the well to ensure there are no inputs of pollutants to groundwater and that there is no subsequent leakage of groundwater, including any gas or other contaminants that this may contain, into the well or to other geological horizons. Details of where the casing will be set and keyed into the low permeability formation beneath a groundwater body once that formation is reached must be set out in the Water Resources Act 1999 Section 199 WR11 notification for this borehole.

## **Acid wash**

In the drilling and construction of any borehole the drilling process can cause a certain level of formation blinding. This blinding results in a reduction in the level of the natural porosity of the rock formation near to the well bore and is referred to as skin damage. To repair this formation blinding and restore the natural porosity of the formation a low pressure acid wash may be applied.

The acid wash treatment will be composed of a 15% hydrochloric acid (HCl) solution. This acid will be neutralised by its interaction with the rock formation and form mineral salts, water and carbon dioxide which will be reverse circulated out of the formation for recovery at surface. Between 5m<sup>3</sup> to 15m<sup>3</sup> of HCl may be pumped into the formation during the operation, with all the acid wash fluids being recovered to surface.

### 3. Waste Management and Waste Characterisation

A waste is defined in Article 3(1) of the Mining Waste Directive by reference to Article 3(1) of the Waste Framework Directive 2008/98/EC. The definition is; *'waste' shall mean any substance or object in the categories set out in Annex I which the holder discards or intends or is required to discard.* The wastes are defined in Article 3 of the Directive as inert, non-hazardous or hazardous as follows:

#### **Hazardous Waste**

The Waste Framework Directive (2008/98/EC) (WFD) sets out what waste is and how it should be managed. The WFD defines some wastes to be hazardous waste. A hazardous waste is defined as a waste that has one or more of the fifteen specified hazardous properties listed in Annex III to the WFD. The application of this is determined by the List of Wastes Decision (2000/532/EC).

Technical Guidance WM3 on the classification and assessment of waste (1st edition 2015) provides a common technical basis for applying the definition of hazardous waste in the UK. This can be found at <https://www.gov.uk/government/publications/hazardous-waste-technical-guidance-wm3>

**Non-hazardous waste** is waste which is neither classed as inert or hazardous.

**Inert Waste** is waste which does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant and in particular not endanger the quality of surface water and/or groundwater.

#### **Extractive Wastes**

The wastes that are generated on the site will be assessed prior to operations commencing. The waste types shall be limited to those within the characterisations and codes set out below. The estimated quantities of extractive wastes to be produced are as set out in the application for this permit.

#### **Waste water based drilling muds**

Waste water based drilling muds will be non-inert non-hazardous waste and shall be limited to the following waste types:

Code Description	Waste Code	Note
<b>Drilling muds and other drilling wastes containing hazardous substances</b>	01 05 06*	These are water based drilling fluids weighted with barite
<b>Barite-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06.</b>	01 05 07	
<b>Drilling muds and other drilling wastes containing hazardous substances</b>	01 05 06*	Water based drilling fluids containing significant levels of chlorides (such as salt-saturated and potassium chloride drilling fluids)
<b>Chloride-containing drilling muds and wastes other than those mentioned in 01 05 05 and 01 05 06.</b>	01 05 08	
<b>Fresh water drilling muds and wastes applies to water-based mud/fluids.</b>	01 05 04	Fresh water based drilling muds (not weighted with barite or containing chlorides)

### **Processed drill cuttings, acid wash returns, spacer and suspension fluid contaminated with water based muds**

The classification for drilling muds given above includes 'drilling muds and wastes'. This means that it includes some other directly related wastes arising from the drilling activity, specifically:

- processed drill cuttings
- acid wash returns, and
- spacer and suspension fluid

These wastes will typically be contaminated with the drilling fluid used, and are classified using the code(s) given above for that type of 'drilling mud and waste'. This means that those used with barite or chloride contaminated drilling muds are potentially hazardous waste and must be assessed for hazardous properties (and persistent organic pollutants) before a classification code can be assigned.

Before being transported off-site drill cuttings will be screened on-site as part of the drilling operation to reduce the surface contamination by water based drilling muds and fluids.

Hydrochloric acid solutions (15%) are used during the acid wash process and in volumes which ensure they are neutralised within the formation. The back circulated flush fluid will also contain rock particles and drilling muds.

### **Waste Oil based drilling muds**

Oil based drilling muds that will be returned to the supplier will not be waste.

If any oil based muds are lost to the formation or spoiled they will be waste 01 05 05\* oil-containing drilling mud and wastes. This entry is an absolute hazardous waste so will always be hazardous.

### **Processed drill cuttings, acid wash returns, spacer and suspension fluid contaminated with oil based muds**

These wastes will typically be contaminated with the oil based drilling fluid used, and are classified using the code 01 05 05\*. This means that those used with oil based drilling muds are similarly hazardous waste and fall within this classification.

Drill cuttings will be screened on site as part of the drilling operation to reduce the surface contamination by oil based drilling muds and fluids and to reduce the amount of waste generated. The processed drill cuttings will be classified as hazardous waste and categorised as above.

### **Hydrocarbons**

Natural gas, should it arise, will display one of the hazardous properties listed in Annex III of the revised Waste Framework Directive and is therefore defined as hazardous waste ("Highly flammable": gaseous substances and preparations which are flammable in air at normal pressure"). The applicable code for this, when waste, is;

16 05 04\* gases in pressure containers (including halons) containing dangerous substances

If oil is encountered it will also display one of the hazardous properties listed in Annex III and when mixed with drilling muds and cuttings will be waste coded as 01 05 05\* oil-containing drilling mud and wastes. This entry is an absolute hazardous waste so will always be hazardous.

## **Non Extractive Wastes**

Wastes will be generated by prospecting that do not directly result from prospecting operations. Examples include office/canteen waste, lubricating oils and greases, diesel, cement, sewage, dirty and surface water.

There will be no treatment or disposal of these wastes on site. Non extractive wastes will be temporarily stored in a secure place, on site pending collection and for no longer than 3 months.

The operator will produce a waste management plan setting out how non-extractive wastes will be monitored, recorded and managed for disposal via an authorised waste carrier. This non extractive waste management plan will be made available to the Environment Agency on request.

## 4. Waste Management and the Waste Hierarchy

Article 4 of the revised EU Waste Framework Directive (Directive 2008/98/EC) sets out five steps for dealing with waste, ranked according to environmental impact - **the 'waste hierarchy'**. <https://www.gov.uk/government/publications/guidance-on-applying-the-waste-hierarchy>

The onsite activities will be conducted so as to prevent waste generation wherever possible, and all appropriate measures will be taken to reduce the quantities generated in all other cases. The waste hierarchy will be applied to all wastes; this means consideration will be given to all possible reuse or recycling of any material either solid, liquid or gas, and the best option selected.

Such measures will include, but are not limited to, those specified in this plan.

### Drilling mud and drill cuttings

The well size will be optimised to reduce the amount of drilling mud required and the drill cuttings produced whilst maintaining a design with satisfactory well control.

Drill cuttings will be separated from the drilling mud, as far as reasonably practicable, at the surface so that the maximum amount of drilling mud can be reused both on site and in the case of oil based mud, at another site. The use of mud cleaners, shakers and centrifuges, to separate the mud from the cuttings, increases the amount of drilling mud that can be reused. It reduces the amount of waste generated and is therefore consistent with the objectives referred to in Article 5 of the Mining Waste Directive.

The following measures will be taken at all times to minimise both the loss of drilling muds and gains of fluids.

- The design of filter cake which has been matched to the formation
- Lost circulation materials to be included in the drilling mud which are non-hazardous and taken from the list in Annex 2 of this plan
- Mud weights suitable for the anticipated formations being drilled

Once the well drilling and construction phase is complete available oil based muds are to be returned to the supplier for re-use as a non-waste material.

### Hydrocarbons

Target formations are expected to be normally pressurised with no over pressure. Well control will be maintained by the weight of the drilling mud used. In the unlikely event formations are found to be over pressurised, anywhere gas is produced this must be managed at the surface.

A blow out preventer will be in place to ensure the wellbore is sealed and any oil or gas circulated out is safely managed. The mud weight will then be adjusted to prevent any further release of gas or oil.

## **Water management**

Modelling of the formation, well design and the use of appropriate mud formulation will be used to minimise the potential for water intrusion during the drilling and construction of the well. If any such water is produced to the surface it should be used in water drilling mud where possible to reduce the amount of waste.

## **5. Site operations and waste handling**

### **Drilling muds and cuttings**

Drill cuttings will be collected and transferred into skips designated for either oil based cuttings or water based cuttings and separate from any spent drilling muds pending collection. The waste cuttings will be separately characterised and removed from site as soon as reasonably practicable for recycling or recovery where possible, by an authorised waste contractor to an appropriately authorised waste management facility. Oil based drill muds will be securely stored and will be returned to the supplier for reuse as a non-waste material.

The site waste controller will inspect all waste storage containers during drilling operations to ensure the discharge of cuttings and spent muds are placed in the correct containers. No containers will be over filled and all reasonable precautions will be taken to prevent spillages occurring. Containers should be covered and the contents removed to an authorised waste management facility as soon as reasonably practicable.

### **Formation testing**

The testing of a rock formation is to establish reservoir engineering data and to establish if and at what pressure the formation becomes permeable.

In order to establish communication between the formation and the wellbore a range of techniques can be used including gated sections of casing and the running of perforating guns into the wellbore which are then fired.

A retrievable packer will then be lowered into the wellbore, immediately above the gates/perforations prior to carrying out any falloff testing or injection tests.

A Leak Off Test (LOT), Diagnostic Fracture Injection Test (DFIT), Mini Fall-off, Data Frac or Mini Frack are all terms used to describe the test to establish the pressure at which fluids are forced into the formation or the point at which the formation begins to fracture. The test will consist of a short duration, small volume operation where between 5m<sup>3</sup> to 10m<sup>3</sup> of potassium chloride solution (KCl) pumped into the isolated section of perforated well and placed under pressure to the point of fracture initiation. This does not involve use of a proppant. At that point valves are then closed allowing the locked in pressure to naturally fall off over the following 24 to 48 hrs and will be monitored for a period of up to 14 days.

On completion of the test, any pressure within the tubing will be released and any remaining KCl water circulated back to the surface. The small volume of KCl water injected into the formation is not expected to be returned to the surface.

## **6. Risk Management measures**

**All appropriate measures will be taken to avoid pollution, the measures employed will include but are not limited to the following:**

### **A. Site containment**

1. The written management system which identifies and minimises the risk of pollution from the materials to be used and the activities to be undertaken will be in place before operations begin and will be implemented throughout the operational phase.
2. An impermeable membrane will be installed across the well pad before the start of any drilling operations using appropriate construction quality assurance standards for the materials being installed. The Operator will ensure the continued integrity of seals in all areas, particularly areas that are trafficked, used for the storage of extractive wastes or where structures are built. All bunded areas for the storage of extractive wastes will be constructed in accordance with CIRIA C736.
3. Only covered skips and enclosed tanks will be used for the temporary storage of extractive waste awaiting collection.
4. A daily visual inspection of all following areas will be conducted to ensure full control and containment of extractive waste materials:
  - pipes and tanks (mud),
  - all storage facilities,
  - shakers, mud cleaners or centrifuges and any other separator equipment.Any equipment failures will be rectified without delay.
5. Spill kits will be available in all areas where extractive wastes are transferred or stored.
6. All surface water drains will have locked valves enabling the site drainage system to be securely isolated and will drain to an interceptor for disposal offsite, or to a watercourse or soakaway, subject to obtaining the relevant permission.
7. Surface water monitoring shall be undertaken on a monthly basis. From site drains and any watercourses within 100m.
8. All waste collection areas and areas used for the deposit and storage of oil based drilling muds will have secondary containment.
9. There will be continuous supervision of the cuttings skips when active mud management is in operation
10. All wastes will be removed from site prior to decommissioning of the site and the removal of site containment systems.
11. No hazardous waste will be stored for longer than is reasonably practicable as part of collection and transportation off site.
12. All equipment cleaning and washing down will take place in a suitably bunded area.

### **B. Chemicals held on site (prior to use)**

1. The Material Safety Data Sheets for all substances used will be made available on site.
2. All chemical storage areas will be clearly marked and will be bunded in accordance with the standards of CIRIA C736
3. No chemicals will be stored on site longer than operationally necessary.

### **C. Site control**

1. The site will be securely fenced so as to ensure no entry by unauthorised persons
2. An environmental management system which identifies and minimises the risk of pollution will be in place prior to the commencement of any drilling operations.
3. The site will be appropriately manned and supervised by competent and suitably trained personnel during operational periods.
4. All site personnel supervising, loading or transferring wastes on site will be trained to use spill kits which will be available at all times.

### **D. Waste removal**

1. Each consignment of waste will be sampled and characterised as soon as reasonably practicable and prior to despatch (and a reference sample retained).
2. Records are to be maintained of the quantities of drill cuttings and their characterisation for at least 2 years.
3. Records of all waste transfers will be retained by the operator for a minimum of 2 years and made available for inspection by the Environment Agency on request.

### **E. Borehole construction and monitoring**

1. Constructed well cellars will be water tight and provide control of any well head spills.
2. Well head methane monitoring using an explosive atmosphere monitor, will be conducted during all stages of drilling.
3. A blow out preventer will be tested, operated and installed on the well which conforms to BS EN ISO 10423:2004.
4. Well cellar integrity will be checked before commencing drilling.
5. All casings and tubing will be tested to the appropriate standards and be appropriate to the pressures and conditions under which they are to be deployed.
6. The mud management system will be continually monitored to assess for any losses or gains.

#### **F. Well Cementing**

1. Cement evaluation logs will be run on casing strings which pass through groundwater-bearing formations. These will be made available for inspection by an authorised officer of the Environment Agency, if requested.
2. A competent cementation contractor will be used for well construction.
3. Cementing process will be monitored and records made available for inspection by the Environment Agency.

#### **G. Loss control**

1. All necessary and reasonable measures will be taken to prevent loss of pollutants to groundwater, including the use of filter cake systems where appropriate.
2. Only lost circulation control material listed in Annex 2 will be used during well construction.

#### **H. Borehole testing**

1. Well head methane monitoring using explosive atmosphere detector will be conducted during all stages of drilling.
2. Mud pit volume totaliser will be used to identify loss of drilling mud to the formation or fluid gains.
3. Well bore returns will be monitored for methane.
4. The operator will ensure mud which may be left in the wellbore does not migrate/leach into rock matrix by the use of loss control measures.

#### **I. Formation testing**

1. Monitoring of pressure pump at all times when in use.
2. All pipework to be pressure checked before any formation testing.
3. Operator to monitor all pipework during formation testing.

#### **J. Drilling Mud**

1. Only low toxicity oil based muds will be used as listed in Annex 1
2. All oil based muds will be contained in tanks with secondary containment
3. The operator will ensure that all spacer fluids used will be water based.
4. The operator will segregate all spacer fluids from all other drilling materials and fluids.
5. The operator will dispose of contaminated spacer fluids via an authorised disposal route.
6. Water based drilling mud mixing tank will have secondary containment.

#### **K. Well Decommissioning**

1. Well decommissioning will be carried out in accordance with the regulatory provisions set out in Section 9 of this WMP.

## **7. Control and monitoring**

### **Baseline monitoring**

Prior to the commencement of any operations the operator is required to undertake a programme of monitoring and sampling to establish the existing environmental conditions of the site. This will include surface water, soil and ground gas sampling and will provide a baseline against which the site closure report will be assessed.

### **Spills and pollution control**

The site will have impermeable containment systems in all bunded areas in line with CIRIA C736. The operator will have a spill management plan which ensures that any material spilt on site will be contained and removed such that this minimises the potential for environmental harm. Staff will be trained in the deployment and use of spill kits prior to commencement of drilling operations.

The pipework and the associated storage tanks of the drilling mud system will be inspected daily for leaks and damage. Where leaks or damage are identified the equipment will be immediately repaired or taken out of service. Any spills will be cleaned up and recorded.

All equipment used on site for the movement of fluid materials will have spill kits available and be operated by or supervised by staff trained in the use of the spill kit.

Details of all spills/accidents will be notified to the Environment Agency in accordance with the permit requirements.

### **Odour and Noise**

The extractive wastes that will be generated are not anticipated to be malodorous and nor are any of the associated processes that will be performed. Measures will be taken to minimise all fugitive emissions which may cause odours.

### **Wastes management**

The quantity of each waste will be recorded as it is removed from site. All records of waste movements (extractive and non-extractive wastes) will be retained by the operator and made available for inspection by the Environment Agency on request.

### **Water management**

In the event that water enters the borehole from formations during drilling operations it will be contained at surface and where possible used to make drilling fluid. Details of the volume of encountered water collected, reused or disposed of by authorised waste contractor shall be retained by the operator and made available to the Environment Agency on request.

## **Natural gas or oil**

In the event of any unexpected gas or oil releases the Environment Agency will be notified in accordance with the permit requirements. Details of the quantities of any oil or gas releases will be recorded by the operator along with the measures taken to manage them and made available to the Environment Agency on request.

## **Complaints**

If any complaints are received about the mining waste operations, they will be recorded, investigated and responded to without delay in accordance with the operator's complaints handling procedures. Complaints will additionally be reported to the Environment Agency within 3 days and a plan detailing appropriate measures to resolve any issue identified.

## **Site Closure Reporting**

The results of all monitoring information collected by the permit holder during the lifetime of this site will be used to update the Site Condition Report for the permitted activities and should include;

- Mud Logs
- Cement evaluation logs (where taken)
- Waste disposal
- Waste storage on site
- Spills on site

This information will be used to inform the final site surrender report.

## **8. Measures for the prevention of environmental pollution**

The operator will keep a hazard register updated throughout the life time of the well. The risk management methods outlined in section 6 above are considered to meet the requirements of the Mining Waste Directive, including the need to prevent water status deterioration and soil pollution.

### **For Oil based drilling fluids**

The operator will ensure that whenever oil based mud is used they should ensure:

- Only group 3 oil based muds will be used <sup>Annex1</sup>
- Segregation of oil based mud contaminated cuttings
- Segregation of cuttings contaminated with hydrocarbons from the formation encountered
- Segregation and safe storage of spent oil based drilling mud
- Oil based mud storage will be within an impermeable bund which conforms to CIRIA C736

## 9. Proposed plan for closure

Once the decision has been taken to abandon the well the closure will be in accordance with established procedures and the following regulatory provisions:

- The Borehole Sites and Operations Regulations 1995 [BSOR];
- the land-based requirements of the Offshore Installations and Wells (Design & Construction etc) Regulations 1996 [DCR];
- Petroleum Exploration and Development Licence (PEDL) 1988.
- the Oil & Gas UK *Guidelines for the suspension and abandonment of wells*

The process of plugging and abandoning the well will require the sealing of any permeable layers within the well, the remainder of the well will be filled with cement between two cement plugs the lower of which should be located at such a level as to prevent any further migration of material from the well into surrounding strata.

The wellhead will be removed and the casings cut and sealed three 3m below ground level. This process will follow the Oil & Gas UK Guidelines for Suspension and Abandonment, and be reviewed by an independent well examiner and the HSE. The site will then be reinstated back to pre-operative state.

When the site is closed, a closure plan will be developed that covers all the required measures detailed in section 3.4 of the Environment Agency's guidance "How to comply with your environmental permit: Additional guidance for: "mining waste operations" as part of any application to surrender the environmental permit. This will cross-reference the updated Site Condition Report and take into account any changes in site conditions.

Link to webpage: <https://www.gov.uk/government/publications/mining-waste-operations-epr-614-additional-guidance>

## Annex 1

Drilling muds which will be used.

### **Water based drilling mud (WBDM):**

Drilling fluids shall exclude hazardous substances as defined in paragraph 4 of Schedule 22 to the EPR 2016 and guidance published by the [Joint Agencies Groundwater Directive Advisory Group](#) (JAGDAG). In the case of principal and secondary aquifers (for which 'groundwater bodies' are defined under the Water Framework Directive) air flush, water only or water-based fluids shall be used. Acceptable additives for water-based fluids in such groundwater bodies are bentonite, food-grade thickeners (e.g. xanthan or guar gums) and inert materials used to increase density (e.g. barite - barium sulphate, haematite - iron oxide). In the event that troubled clay formations are drilled 3-7% of KCl may be added in order to set the casing and cover the aquifer.

**Oil based Drilling mud (OBDM):** 45-55% non-aqueous phase, 30-40% Barite (weight additive), 18% brine 2% emulsifier, 1% gellatents/others)

### ***Group III: low/negligible-aromatic content fluids. Low Toxicity Drilling mud***

This group includes fluids produced by chemical reactions and highly refined mineral oils which contain levels of total aromatics below 0.5% and polycyclic aromatic hydrocarbon (PAH) levels below 0.001%, according to the OGP definition.

## **Annex 2**

### **Managing lost circulation materials**

Clay

Cedar Fibre

Sawdust

Calcium Carbonate MS

Mica

Groundnut shells

Walnut

Cement plugs

## **Annex 3**

### **Glossary and Definitions**

**Blow out preventer:** a valve device placed on the top of the well which can be closed. It is a safety feature used in case the drill enters an over pressure formation which could result in the entire drill string being blown out of the well

**CIRIA C736:** Construction standards for all containment systems for the prevention of pollution, used by the Environment Agency to describe good practice.

**Formation Integrity Test (FIT):** methodology to test strength of formation by increasing Bottom Hole Pressure (BHP) to designed pressure. FIT is normally conducted to ensure that formation below a casing shoe will not be broken while drilling the next section with higher BHP or circulating gas influx in a well control situation.

**Formation testing:** includes all aspects of determining the tensile strength of the formation and improving its porosity and through this the permeability of the rock.

**Formation water:** is water which occurs naturally within the pore space of the rock formation

**Hydrocarbons:** collective term used to describe all mineral oils and natural gas

**Lithology:** The different geology and characteristics of the rock

**Mud Pit Volume Totaliser – MPVT:** system for monitoring in the real time any losses or gain of fluids within the mud system

**Produced water:** This term describes the water produced back from the formation to the well bore.

**PVT:** abbreviation for pressure, volume, temperature.

**Well Bore:** The inside of the borehole which has been drilled through the different lithologies