West Newton Wellsite Odour Management Plan

Rev:	Prepared By:	Checked By:	Approved By:	Issued:
1.00	Sean Smart	Tom Selkirk	D Montagu-Smith	20/09/2014

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1 INTRODUCTION

Rathlin Energy (UK) Limited (Rathlin Energy) is a wholly owned subsidiary of Connaught Oil & Gas Ltd, a private company with its head office in Calgary, Canada. Connaught Oil & Gas Ltd is an international petroleum exploration, development and production company with operations in Western Canada and the United Kingdom. The experienced senior management team has an average of 30 years of direct operating experience in Canada and internationally. The United Kingdom operations are conducted through Rathlin Energy (UK) Limited and are directed from the Rathlin office in London.

Rathlin Energy is engaged in the exploration and production of petroleum onshore United Kingdom and holds 100% interest in Petroleum Exploration and Development Licence (PEDL) 183, within which it has drilled two exploration boreholes, Crawberry Hill 1 and West Newton 1.

The West Newton exploration wellsite was granted planning permission by East Riding of Yorkshire Council in January 2013. A copy of the planning decision notice DC/12/04193/STPLF/STRAT is included within 'West Newton Wellsite Planning Decision Notice' (RE-05-EPRA-WN-PDN-009) provided in support the of environmental permit application. The site was constructed in 2nd quarter 2013 and the drilling of the West Newton 1 well was completed in 3rd quarter 2013. The well has subsequently been suspended pending analysis of the data gathered during the drilling operation.

The purpose of this document is to outline the odour management arrangements to be implemented at the West Newton wellsite during exploratory operations, which for clarity includes the testing of the existing WN1 well, the drilling and testing of WN2 well and wellsite restoration operations, permitted under the existing planning consent.

1.1 Site Details

The proposed West Newton exploratory operations are being undertaken at the following location:

West Newton Wellsite
Rathlin Energy (UK) Limited
Fosham Road
Marton
Hull
HU11 5DA

National Grid Ref: TA 19268 39131

Site Area: 0.975 hectares

Waste Registration Number: OGS795

The site surface boundary is detailed in green on the site plans included as Appendix 1 within this Odour Management Plan.

2 SCOPE

This Odour Management Plan is applicable to the West Newton wellsite and all exploratory operations permitted therein, in accordance with the existing planning consent. It is applicable to Rathlin Energy its contractors and subcontractors and can be used in support of applications to the Environment Agency under the Environmental Permitting (England & Wales) Regulations 2010, where there is a requirement to provide an Odour Management Plan.

This Odour Management Plan has been prepared in accordance with the requirements of the Environment Agency guidance for H4 Odour Management; *How to comply with your environmental permit.*

3 DEFINITIONS

BAT:	Best Available Technique
EA:	Environment Agency
EMS:	Environmental Management System
HSE:	Health, Safety and Environment
Inert Waste:	A waste that does not undergo any significant physical, chemical or biological transformations. Does not give rise to environmental pollution or harmful to health
MMSCF:	Million Standard Cubic Feet
NGL:	Natural Gas Liquids
OMP:	Odour Management Plan
PSI:	Pound per Square Inch
SCF:	Standard Cubic Feet
SMS:	Safety Management System;
WN1:	West Newton 1 Well
<:	Less Than
>:	Greater Than

4 ODOUR ASSESSMENT

In accordance with the Rathlin Energy Odour Management Standard, an assessment of the characteristics and severity of odour emissions must be undertaken. The assessment shall follow the environment agency H4 guidance adopting the following FIDOR process:

- Frequency of detection;
- Intensity as perceived;
- Duration of exposure;
- Offensiveness; and
- Receptor sensitivity.

4.1 Frequency

The frequency of odour can be assessed from emissions and process control data, wind direction data, complaints received and odour diaries. Rathlin Energy will investigate all complaints received in relation to odour, whilst also monitoring the frequency at which complaints are received and recording each complaint to provide a log.

4.2 Intensity

The Intensity of any odour can be assessed from monitoring information such as sniff testing (which provides a judgement on intensity and offensiveness), a field dilution olfactometer, complaints and odour diaries and emissions or ambient air monitoring when feasible to do so. If available, information from comparative sites shall also be used when assessing odour intensity.

4.3 Duration of exposure

As with frequency, duration of odour exposure can be assessed by various methods including emissions and process control data, wind direction data, complaints received and odour diaries.

4.4 Offensiveness

The offensiveness of an odour can be qualified using two methods, odour attributes and hedonic tone.

More generally the exposure attributes will determine the nuisance sensitivity, how an individual or individuals perceive the odour. Hedonic tone is measured under laboratory conditions and aims to qualify the odour as simply "like" or "dislike".

During site operations Rathlin Energy has personnel onsite who are able to assess the offensiveness and intensity of any odours present onsite, thus providing an early indication of a potential odour complaint.

Some odours are more unpleasant and volatile than others and will affect all persons and receptors differently. Likewise individual's familiarity of odours, for example industry specific odours, must be taken into consideration.

4.5 Receptor Sensitivity

Receptor sensitivity varies with each wellsite location and is dictated by the number and types of receptors adjacent to the wellsite. Examples of receptors are residential properties, commercial properties, wildlife sites, SSSI, etc. Rathlin Energy understands that each receptor may react to an odour differently. When undergoing the site selection process Rathlin Energy takes into consideration the sensitivity of these receptors, the distance from the proposed wellsite and the impacts the proposed operations may have. Wherever possible the wellsite is located in the least environmentally sensitive area in relation to the sensitive receptors thus ensuring overall minimal impact.

5 ODOUR CONTROL

Rathlin Energy has a moral and regulatory duty to reduce the amount of odorous emissions as a consequence of its operations to as low as reasonably practicable. Ordinarily, wellsite operations are not expected to give rise to significant odorous emissions, however, should odorous emissions be identified, be it through personnel onsite or through complaints monitoring, immediate steps must be undertaken to identify the source of the odour and implement suitable measures to control the emissions.

Rathlin Energy site specific Odour Management Plans adopt the principle of Best Available Technique (BAT) using the following odour control hierarchy:

5.1 Odour Identification

Given the nature of operations being undertaken at Rathlin Energy wellsites, the complexity of subsurface geology and the potential naturally occurring petroleum present therein, it is important to establish the odour source and its exact properties. Individual elements within petroleum can vary significantly and therefore detailed analysis must be undertaken.

Sources of odour not associated with the subsurface operation, such as canteen waste, waste waters or sewage are much less complex and less likely to require detailed analysis.

Where the potential source of the odour is considered to be complex, possible odour source sampling shall be undertaken using appropriate and approved techniques prescribed by the Rathlin Energy's environmental monitoring consultant. The samples shall then be sent for analysis under laboratory conditions.

Once the odour source samples have been analysed and the likely source or element within the source identified, appropriate control measure shall be identified.

5.2 Odour Prevention

Measures to prevent odour emissions are detailed below:

- Use of alternative processes to prevent odour;
- Use of alternative products that, when reacting with other substances, do not produce odours;
- Suitable storage;
- Promotion of good housekeeping;

Where none of the above prevention methods are feasible, odour minimisation shall be considered as per section 5.3 below.

5.3 Odour Minimisation

If prevention is not possible or viable then the next step in the odour management hierarchy is to minimise odour emissions. This can be achieved by reducing the odour at source or by reducing the amount of odour emissions released from source. The following methods are examples of odour minimisation:

- Reducing the amount of odorous sources;
- Reducing the surface area of the odorous source reducing evaporation rate;
- Avoiding prolonged operations.

5.4 Control of Odour Emissions

Where prevention and minimisation are not possible or viable, mitigation measures to control the release of odour emissions must be considered. The following methods are examples of odour control:

- Use of chemical scrubbers to remove odorous emission prior to release;
- Use of incinerators/flares to burn odorous gases;
- Contain any potential odours until they can be treated and subsequently released;
- Contain and transport any odorous sources offsite to an Environment Agency permitted facility for subsequent treatment and disposal;
- Use of odour killing sprays/blankets.

5.5 Contractor Performance

Rathlin Energy is ultimately responsible for any odour generated on site during the West Newton exploratory operations. Rathlin Energy will not delegate its responsibilities or accountabilities as Operator to a contractor.

Contractors, who are involved in the generating of odour will first have been selected in accordance with Rathlin Energy's Management of Contractor's Safety and Performance Standard (RE-03-002) and, under that standard, are then subject to periodic monitoring of their performance.

6 MONITORING

To ensure the effectiveness of odour control measures, monitoring shall be undertaken immediately following the implementation of control measures. Thereafter, periodic monitoring shall be undertaken to ensure the continued effectiveness of control measures.

Examples of monitoring methods are detailed below with specific monitoring techniques detailed within Section 11 of this Odour Management Plan:

6.1 Release Point Monitoring

In the course of implementing control measures, new release points may have been established. To ensure the effectiveness and suitability of these release points, monitoring shall be undertaken.

6.2 Ambient Air Monitoring

Ambient air quality monitoring will be undertaken onsite following the identification of an odour and the subsequent implementation of control measures. Such ambient air quality monitoring and analysis shall be undertaken in accordance with applicable standards and carried out by Rathlin Energy's independent air quality monitoring consultants.

6.3 Complaints Monitoring

Rathlin Energy shall log all complaints made by site personnel, contractors, sub-contractors, stakeholders, neighbours and the general public. Once a complaint has been made and the relevant complaint form has been completed, a record will be kept and a log created with a subjective description of each complaint allowing Rathlin Energy to calculate the number of complaints relating to odour.

6.4 Results Monitoring

Rathlin Energy shall maintain a record of all odour monitoring and subsequent analysis; records shall include the following;

- Date, time and details of emissions points sampled;
- Method of sampling;
- Weather conditions.
- Sample preservation and transportation;
- The laboratory details (where the results are analysed);
- Lab reports and observations

6.5 Complaints

In the event that a complaint is received from stakeholders, including neighbours, the complaint shall be recorded and investigated in accordance with Rathlin Energy's safety and environmental management systems.

Complaints relating to the environment will be reported to the Environment Agency and actions to prevent reoccurrence will be agreed, together with a programme for implementation. Implementation of the actions will be monitored and the Environment Agency informed.

7 WEST NEWTON ODOUR SOURCE

The West Newton wellsite is currently experiencing an odour emission which has been reported by site personnel, local residents and Environment Agency officers.

An initial review of the odour suspected naturally occurring constituents within un-burned natural gas and wellbore fluids as being the likely source of the odour. Rathlin Energy's air quality monitoring consultants, Environmental Scientific Group (ESG), were mobilised to site to obtain samples of the gas for subsequent analysis.

A detailed analysis of the samples was carried out under laboratory conditions in order to identify the true source of the odour within the gas, which in turn would be used to determine the most appropriate odour control measures.

The gas analysis identified that the source of the odour is a combination of a number of constituents, commonly referred to a Natural Gas Liquids or NGLs (Butane, Pentanes, Benzene, Hexanes and Heptane), which are naturally occurring within the gas and formation fluid. Ordinarily, these Natural Gas Liquids would be incinerated at the point of flare, however, at low flow rate pressure, they are not being incinerated and their respective odours are being emitted.

8 RELEASE POINTS

A review of the operations identified the following two odour release points.

8.1 Point of Flare within Flare Unit

During well testing operations, formation gas recovered at surface, including any odourous Natural Gas Liquids, is incinerated at the point of flare. The gas delivery pressure at the flare unit is required to be >1.2 bar(g) in order to establish combustion. At a delivery pressure <1.2 bar(g) there is insufficient pressure to overcome the downward flow of air generated by premix fans within the flare, thus not allowing the gas to reach the Propane pilot light. The downward flow of air pushes the gas to a release point at the venturi opening at the base of the flare unit.

At the present stage of test operations the reservoir formation is not delivering a consistent and continuous flow of gas to surface at flowing pressure above the 1.2 bar(g) flare limitation. This is not uncommon in the early stage of well flow testing, prior to the well 'cleaning up'. Following 'clean up' it is expected that the formation will deliver a continuous flow of gas at pressures in excess of the 1.2 bar(g) minimum pressure limitation of the flare unit. Based on information recorded to date during testing, reservoir pressures, estimated at 2650 psi are capable of delivering gas at continuous pressures to the flare in the 1.2 bar(g) to 8 bar(g) range.

8.2 Wellbore Fluid Storage Tanks

Wellbore fluids, which come to surface with the gas, are separated on surface using a three phase separator. Gas is diverted to the flare unit for incineration and wellbore fluids are diverted to fluid storage tanks onsite, where they are held for subsequent offsite treatment and disposal. The same constituents that are found in the gas stream are also entrained within the wellbore fluids. A vent line on top of the fluid storage tank is allowing the odour to be released from the tank.

Although not currently considered a release point, the rigging down of all equipment that has been in contact with the odour source at the end of the well testing operations may present a number of possible release points. Odour control measures have been considered during rigging down operations and are included in Section 10.

9 IMPACTS

Site selection, in particular the separation distance between the site and sensitive receptors, is an important factor when considering petroleum exploration operations and their potential impact on the surrounding environment. Whilst odour emissions are not generally of concern due to their minimal potential, they are a consideration, together with noise and lighting emissions.

The West Newton wellsite is located within a rural landscape within the East Riding of Yorkshire. The nearest conurbations are West Newton, 1,130 metres to the south and Marton, 800 metres to the west. The nearest residential properties are:

Black Bush Farm – 625m North East

Cayley Cottage – 670m East

Woodend Farm – 640m West

The Old School House – 640m South West

The prevailing wind direction is south-westerly with occasionally wind directions being easterly.

The West Newton wellsite is not situated on or within a statutory or non-statutory designated site. There is one statutory designated site approximately 1,000 metres to the northeast, Lambwath Meadows, which is a Site of Specific Scientific Interest (SSSI).

Four Local Wildlife Sites (LWS) have been identified within 1,000 metres of the wellsite. The closest, 400 metres north, is the Lambwath Stream. The area is predominantly arable fields with interspersed woodland and hedgerows.

An independent phase 1 habitat survey was completed and submitted in support of the planning application. The survey did not identify any protected species within or adjacent to the development site. A survey was made of the ditch on the western and southern boundaries of the field for Water

Voles, however, the survey found that the conditions are suboptimal due to much of the stream being dry.

A number of odour complaints have been received via various means, including the Environmental Agency website, Community Liaison Meeting and social media, the latter attributed to the presence of Anti-Fracking Protestors taking up residence immediately outside of the site.

To date there have been a total of four (4) complaints made direct to the Environment Agency and one comment received via the Community Liaison Meeting. The complaints received via the Environment Agency website report of health effects, symptoms of eyes and throat being affected, coughing and lungs hurting. These symptoms have not been substantiated by Rathlin Energy or the Environment Agency. Public Health England has been contacted by the Environment Agency.

10 SPECIFIC ODOUR CONTROL MEASURES

Detailed gas analysis identified that the source of the odour as being a combination of a number of Natural Gas Liquids, which are naturally occurring within the gas and formation fluid. As Natural Gas Liquids are naturally occurring within the reservoir formation it is possible to separate these constituents prior to flowing of gas and fluids to surface. It is not possible to eliminate, substitute or reduce this odour at source within the reservoir.

Ordinarily, these Natural Gas Liquids would be incinerated at the point of flare, resulting in any odours associated with this product being removed. As a result of low gas delivery rates to the flare unit the product is not being incinerated.

The gas delivery pressure at the flare unit is dictated by the formation pressure within the well, which is sufficient following 'well clean up' to deliver gas to the flare at pressures well in excess of the 1.2 bar(g) minimum operating pressure for the flare. A variety of standard oilfield practices may be employed in order to assist the reservoir formation in this 'clean-up process'. For example, the back pressure on the reservoir provided by the standing fluid column in the tubing can be reduced by swabbing to manually remove fluid from the well or with the use of Nitrogen (N_2) under pressure to displace the fluid from tubing, thereby reducing the backpressure on the formation and improving the potential for continuous flow to surface from the reservoir. Once the hydrostatic weight of the fluid column in the well is removed, a higher, more consistent and continuous gas delivery pressure is anticipated and the Natural Gas Liquids will be fully incinerated. In order to get to this position, however, the operation must first continue to reduce the hydrostatic weight of the fluid column.

As it is not possible to eliminate, substitute or reduce the odour source in the reservoir, measures to control, eliminate and reduce the odour at surface have been identified and a scheme to monitor their effectiveness established.

The following subsections set out the proposed odour control measures. Measures to monitor the effective of the odour control measures are detailed in Section 11.

10.1 How Rathlin Energy will Deal with the odour

10.1.1 Receipt and Management of Odorous Products

The odorous products identified at the West Newton wellsite is a combination of a number of Natural Gas Liquids, which naturally occur within the formation being tested. It is not foreseeable that Rathlin Energy will receive other odorous materials from its contractors or subcontractors, however, any contractors or subcontractor equipment that comes into contact with the product pre-incineration will potentially be a point source of odour during rigging down, following completion of the well testing operations.

Any equipment that has, or has the potential, to come into contact with the odorous product shall be logged and used to establish an odour prevention procedure in advance of rigging down.

If the site becomes a receiver of other odorous products during the course of the West Newton operations, then this Odour Management Plan will be reviewed and updated accordingly.

10.1.2 Containment of Exposed Air

Containment of exposed air refers to any gas or air that has come into contact with the odorous product and that itself has, in turn, become odorous.

It is imperative to the success of this Odour Management Plan that any equipment having the potential to contain gas or air that has come into contact with the odorous product is logged and the log is used to establish further odour prevention measures such as chemical scrubbing or incineration. Until such time as the odour prevention measures are implemented, all equipment having the potential to release gas or exposed air shall be shut in thereby containing the odours. It should be noted that the shutting in of the equipment is only a temporary odour control measure.

10.1.3 Scrubbing Treatment

Due to the source of the odour being naturally occurring within the formation and it not practicable to eliminate, substitute or reduce the odour at source, industry practise is to deploy a scrubbing agent, for example hydrogen peroxide may be used in certain applications to remove odours from the gas stream.

Due to the potential of various odorous emissions being present in the unburned gas, several scrubbing agents may have to be utilised to ensure that odorous emissions remain at an acceptable level. Rathlin Energy recognises that this is not Best Available Technique and other means of mitigation shall be undertaken.

Scrubbing treatment has already been applied to the fluid storage tank, which receives and stores wellbore fluids post three phase separation. The same constituents that are found in the gas are entrained within the wellbore fluids. A vent line on top of the fluid storage tank was allowing the odour to be released from the tank. A hose has now been connected from the vent line to a container holding Potassium Permanganate. Any air vented from the fluid storage tank is now scrubbed through the Potassium Permanganate, which is removing the odorous emission.

10.1.4 Incineration of Natural Gas

In order to establish whether natural gas can be produced in a commercially viable quantity, a flow test is carried out, which results in natural gas and formation fluids being brought to surface through the wellbore. Where there is no means to capture and use natural gas during well testing operations, Best Available Technique for the disposal of natural gas is incineration using an enclosed flare.

The delivery pressure at the flare unit is required to be >1.2 bar(g) in order to establish combustion. At a delivery pressure <1.2 bar(g) there is insufficient pressure to overcome the downward flow of air generated by premix fans within the flare, thus not allowing the gas to reach the propane pilot light. The downward flow of air pushes the gas to a release point at the venturi opening at the base of the flare unit. This release of gas is known as cold venting, which is not a suitable method of disposing of the gas.

The well continually builds up pressure when shut in. When the well is opened up to flow the wellhead pressure starts to reduce. Cold venting of natural gas is occurring when the delivery pressure to the flare unit falls below 1.2 bar(g). In order to eliminate cold venting of natural gas, Rathlin Energy will continually monitor the pressure drop during well flow and will shut in the well when the pressure reduces to 2 bar(g). Not flowing the well when the pressure is below 2 bar(g) will ensure Rathlin Energy operate the flare unit within the parameters at which incineration occurs.

As per the West Newton environmental permit, Nitrogen injection into the well is being used to help reduce the hydrostatic fluid column in the well.

10.1.5 Breaking Containment of Equipment during The Well Testing Operations

At various junctures in the well testing operations, it will be required to break containment of the equipment. Typically this is expected when the wireline pressure control equipment on top of the well is opened to change the downhole tools on the wireline. In this instance, odour release will be mitigated by purging the equipment with Nitrogen, the Nitrogen and odour mix being injected into the well and the well isolated before containment broken. As the positive Nitrogen pressure is bled off prior to breaking containment, this will be monitored to ensure all odours have been eliminated. If this is not the case, further Nitrogen purging will take place.

When any planned, or unplanned, breaking of containment takes place, the operations will be risk assessed for odour release and mitigations put in place.

10.1.6 Rigging Down of Equipment

Equipment that has been in contact with the odour source has the potential to be a point source of odour emission during its deconstruction (rigging down) following completion of the well testing operations.

A list of equipment which has come into contact with the odour source will have been established during well test operations and prior to commencing rigging down operations. As each piece of equipment can vary in terms of size, shape, volume, process used etc. it is important that the decontamination process for each individual piece of equipment is established in advance.

As an aide memoir, the following is provided as examples of how specific equipment will be decontaminated:

Equipment:	Decontamination Method:	Waste Receptor:
Fluid Storage Tank	Nitrogen and fluid purge via scrubber	IBC Scrubber
Three Phase Separator	Purge with nitrogen	Incineration of NGLs at Flare Stack. (Pressure controlled at separator to ensure continuous ignition within the flare stack)
Flow Lines	Fluid purge via scrubber. Odour kill spray at point of dismantle.	IBC Scrubber
Flare Stack	Purge with propane	Incineration of NGLs at Flare Stack
Wire Line Equipment	Fluid purge via scrubber. Odour kill spray at point of dismantle.	IBC Scrubber
BOP	Purge with nitrogen	Incineration of NGLs at Flare Stack. (Pressure controlled at separator to ensure continuous ignition within the flare stack)
Coil Tubing	Fluid purge via scrubber. Odour kill spray at point of dismantle.	IBC Scrubber
IBC Scrubber	Odour kill spray at point of dismantle.	Chemicals / Materials used within the scrubber will be analysed and transported to Environment Agency approved waste treatment facility for treatment / final disposal

11 MONITORING TECHNIQUES

Monitoring techniques used to assess both the amount of natural gas cold vented from the flare unit and the effectiveness of the odour control measures to be implemented are detailed below. Using the techniques detailed below the volumes of gas having been flared and cold vented during the West Newton well testing operations have been established and included as Appendix 3.

11.1 Gas Sampling

The composition of natural gas in reservoirs changes over geological time (millions of years), which in terms of scale is not easily measureable. Gas composition can also change during production, as a consequence of reservoir depletion. Such changes occur over a number of years.

Relatively short duration changes to gas composition in wells can be a result of installing a completion, when contaminants such as CO2 and CO are produced. In terms of the West Newton well, this would not significantly affect the levels of Natural Gas Liquids, which are naturally occurring hydrocarbons.

Rathlin Energy believes the most effective method of obtaining a representative sample of the gas in the West Newton well is to obtain a pressurised gas sampling at the wellhead.

Rathlin Energy proposes to acquire a number of quality samples once the well has started to flow and the extended well test confirms the gas composition.

11.2 Gas Rates

Calculating gas rates using pressure drop over a known restriction, such as a choke or an orifice plate, is standard oilfield practice. Orifice plate dry flow meters are currently considered to be best practice.

During flow testing, Rathlin Energy proposes to have constant flow rate monitoring and calculation using a flow meter situated at the three phase test separator. Initial attempts to establish flow resulted in a number of short duration pressure bleed downs. This in turn resulted in difficulties obtaining accurate flow rate measurements.

Such flow rate monitoring and calculation is considered by Rathlin Energy to be the most reliable method of establishing gas flow rates when considering a wide spectrum of pressure, temperature and flow rates. It is the least likely method to fail or foul. Whilst Rathlin Energy accepts it is a simple system, it is uncomplicated, proven and reliable. In comparison, Pitot Tube Meters are not generally used for raw natural gas test operations due to their unreliability.

11.3 Velocity

Using flow rate calculations, flow pressures and internal diameter of the tubing, it is possible to calculate the velocity within the flowline.

11.4 Ambient Air Quality Monitoring

Ambient air quality monitoring is deployed at the wellsite and forms part of the ongoing environmental monitoring, which includes water quality and noise.

Additional ambient air quality monitoring will be undertaken during the initial start-up of flow testing operations, the purpose of which is to monitor the effectiveness of the odour control measures. The aim of the ambient air quality monitoring is to confirm that no odour emissions are being released beyond the confines of the West Newton wellsite. Additional monitoring locations will be established outside of the wellsite at the nearest sensitive receptors, taking into consideration their proximity to the wellsite and wind direction.

Ambient air quality monitoring method is detailed below:

Substance:	BTEX Compounds, VOC's (Semi Quantitative) and Dimethyl Disulphide
Analytical Method:	ATD-GC-MS
Sampling Method:	Personal sampling pump with constant pressure controller, tube holder with tygon tubing
Pump Flow Rate:	20 ml.min^{-1}
Sample Duration:	10 minutes
Sample Media:	Dual Bed Sulfinert (Tenax TA/Spherocarb) ATD Tube
Analysis Preparation:	1.5 litre dry nitrogen purge
Instrument Calibration:	5 level calibration for BTEX Compounds & DMS Semi Quantitative VOC's quantified using Toluene peak
Analytical Instrument(s):	Perkin Elmer Turbo Matrix ATD/Agilent 6890/5973N GC-MS (Scan Mode)
Reference Method(s):	In house methods ASC/SOP/209, ASC/SOP/210 & ASC/SOP/211
Analysis Laboratory:	ESG Specialist Chemistry, Bretby
Accreditation:	UKAS for mass of BTEX Compounds

Casella 'TUF' personal sampling pumps equipped as detailed above will be used. Each pump will be calibrated at a flow rate of 20 ml.min-1, using a Bios International Dry Cal 'Defender 510' flow measurement device.

This sample collection criterion allows a limit of detection for Dimethyl Sulphide of 10 ng on tube, equating to an airborne concentration of 50 μg.m-3.

'Grab samples' taken using hand aspirators/Tedlar bags will also be taken at each location and returned to the laboratory for analysis for the following gases

Gases:	Analytical Method:	LOD (ppm):	UKAS Accredited:
Methane, Ethane, Propane, Butane, Pentane, n-Hexane, Heptane & Octane	GC-FID	5	Yes

Hydrogen Sulphide	CC-FPD	1	No

Results will be provided in Test Report format as factual data, detailing all relevant sample collection information, analysis results and calculated airborne concentrations for the substances analysed for.

12 ALTERATIONS TO THE PLAN

Any required changes or deviations from this plan are to be referred to the Rathlin Energy HSE & Planning Manager or to the site HSE Adviser in the first instance. No changes to, or deviations from, this plan are to be implemented until the required changes or deviations have been reviewed and approved by Rathlin Energy and the relevant approvals obtained in writing from the Environment Agency for any changes to the plans and operating techniques approved under the environmental permit.

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APPENDIX 1 – SITE LOCATION PLAN

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West Newton Wellsite
Site Plans
Exploratory Operations

Rev:	Prepared By:	Checked By:	Approved By:	Issued:
1.00	Jonathan Foster	Tom Selkirk	D Montagu-Smith	16/01/2014

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Key:

Site Boundary

Rathlin Energy

Rathlin Energy (UK) Limited
8 Wimpole Street
London
W1G 9SP

Job Title:
West Newton Wellsite

Drawing Title:
Site Plan

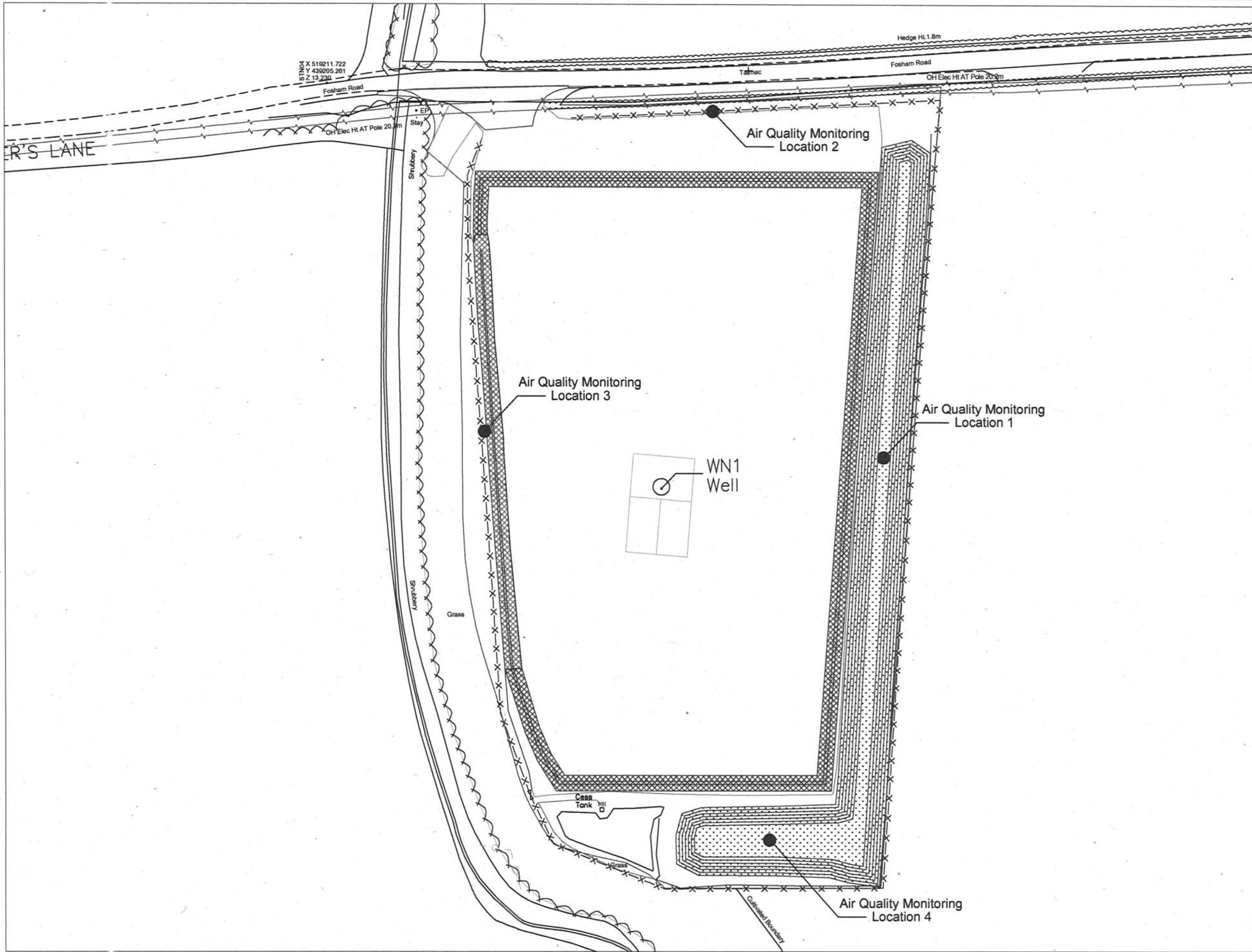
Scale: 1:5,000 (Print A3)

Date: 16th January 2014

Drawn By:
Jonathan Foster

Drawing No:
RE-05-EPRA-WN-SP-004-01

Rev: 0



Key:

Site Boundary	
Topsoil Storage Bund	
Open Perimeter Drainage Ditch	
Piped Perimeter Drainage Ditch	
Air Quality Monitoring Locations	●

Rathlin Energy

Rathlin Energy (UK) Limited
8 Wimpole Street
London
W1G 9SP

Job Title:
West Newton Wellsite

Drawing Title:
As-Built Plan

Scale: 1:500 (Print A3)

Date: 16th January 2014

Drawn By:
Jonathan Foster

Drawing No:
RE-05-EPRA-WN-SP-004-02

Rev: 0

APPENDIX 2 – EMISSIONS MONITORING AND ANALYSIS

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Environmental Scientifics Group

Analysis of Tedlar Bags for VOCs

Client:	Neil Fenwick Environmental Scientifics Group Ltd Etwall House Bretby Business Park Ashby Road Burton on Trent DE15 0YZ
Testing Facility:	Environmental Scientifics Group Ltd Specialist Chemistry Etwall House Bretby Business Park Ashby Road Burton on Trent DE15 0YZ
Laboratory Reference:	ASC/16028
Customer Reference:	West Newton
Samples Received:	16th September 2014
Sample Condition:	See Introduction
Analysis Completed:	17th September 2014

Approved by:

Date 17SEP14

Approver's name:	Paul Walker
Job Title:	Organic Team Leader
Report Date:	17th September 2014

ESG Environmental Scientifics Group

Introduction

Two tedlar bag samples were received for the analysis of the Benzene, Toluene, Ethyl Benzene, Xylene and a VOC screen. The samples arrived in good condition and were stored in a temperature controlled solvent free environment prior to analysis.

Experimental

120ml of the gas was transferred onto a mixed bed ATD tube and analysed by ATD-GC-MS using a Markes ATD linked to an Agilent 7890/5975 GC-MS operating in scan mode.

Benzene, Toluene, Ethyl Benzene and Xylene was quantified against a calibration of standards spiked onto mixed bed ATD tubes.

The top 10 most abundant VOCs (with particular attention paid to sulphurous compounds) were tentatively identified by mass spectral data and semi-quantified against the response of the internal standard (d^8 Toluene)

Results

The results for the VOCs are provided in the following tables.

Results

	ASC/16028.001 West Newton Headspace (mgm^{-3})
Benzene	<0.04
Toluene	0.04
Ethyl benzene	<0.04
m,p-Xylene	<0.04
o-Xylene	<0.04
N,N-dimethylacetamide	2.1
Phenol	0.39
Decanal	0.14

	ASC/16028.002 West Newton Under Flare (mgm^{-3})
Benzene	<0.04
Toluene	<0.04
Ethyl benzene	<0.04
m,p-Xylene	<0.04
o-Xylene	<0.04
N,N-dimethylacetamide	0.27
Phenol	0.15
Decanal	0.16

Environmental Scientifics Group

Analysis of Tedlar Bags for VOCs

Client:	Neil Fenwick Environmental Scientifics Group Ltd Etwall House Bretby Business Park Ashby Road Burton on Trent DE15 0YZ
Testing Facility:	Environmental Scientifics Group Ltd Specialist Chemistry Etwall House Bretby Business Park Ashby Road Burton on Trent DE15 0YZ
Laboratory Reference:	ASC/16035
Customer Reference:	West Newton 2
Samples Received:	17th September 2014
Sample Condition:	See Introduction
Analysis Completed:	18th September 2014
Approved by:	[signature]
Date	18 SEP 14.
Approver's name:	Paul Walker
Job Title:	Organic Team Leader
Report Date:	18th September 2014

Introduction

Six tedlar bag samples were received for the analysis of the Benzene, Toluene, Ethyl Benzene, Xylene and a VOC screen. The samples arrived in good condition and were stored in a temperature controlled solvent free environment prior to analysis.

Experimental

Between 1ml and 120ml of the gas was transferred onto a mixed bed ATD tube and analysed by ATD-GC-MS using a Markes ATD linked to an Agilent 7890/5975 GC-MS operating in scan mode.

Benzene, Toluene, Ethyl Benzene and Xylene was quantified against a calibration of standards spiked onto mixed bed ATD tubes.

The top 10 most abundant VOCs (with particular attention paid to sulphurous compounds) were tentatively identified by mass spectral data and semi-quantified against the response of the internal standard (d^8 Toluene)

Results

The results for the VOCs are provided in the following tables.

Results

	ASC/16035.001 Flare 16/9/14 (mgm^{-3})
Benzene	37
Toluene	12
Ethyl benzene	0.83
m,p-Xylene	0.64
o-Xylene	0.40
2-Methylbutane	24
Pentane	23
2-Methylpentane	6.9
Hexane	4.6
Methylcyclopentane	4.4
Heptane	12
Diethyl sulphide	6.4
Methylcyclohexane	6.7
2-(ethylthio)propane	2.8
Octane	7.7

	ASC/16035.002 Between points 2 & 3 on hill (mgm^{-3})
Benzene	<0.04
Toluene	<0.04
Ethyl benzene	<0.04
m,p-Xylene	<0.04
o-Xylene	<0.04
Acetic acid	0.14
Phenol	0.07
Nonanal	0.07

	ASC/16035.003 **The Presbytery off main road** **(mgm^{-3})**
Benzene	0.15
Toluene	0.10
Ethyl benzene	<0.04
m,p-Xylene	<0.04
o-Xylene	<0.04
Acetic acid	0.09
Boric acid, trimethyl ester	0.10
Heptane	0.07
Diethyl sulphide	0.03
3-Methylheptane	0.10
Phenol	0.09

	ASC/16035.004 **Choke line during vent** **(mgm^{-3})**
Benzene	200
Toluene	21
Ethyl benzene	1.7
m,p-Xylene	1.4
o-Xylene	0.96
2-Methylbutane	1600
Pentane	1200
2-Methylpentane	320
3-Methylpentane	110
Hexane	74
Methylcyclopentane	55
3-Methylhexane	28
Heptane	50
Diethyl sulphide	23
Methylcyclohexane	53

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	ASC/16035.005 Flare C/V swab return to surface (mgm^{-3})
Benzene	6.6
Toluene	1.5
Ethyl benzene	0.15
m,p-Xylene	0.14
o-Xylene	0.10
2-Methylbutane	4.3
Pentane	4.7
2-Methylpentane	2.5
3-Methylpentane	1.1
Hexane	1.2
Methylcyclopentane	1.1
Heptane	2.2
Diethyl sulphide	0.99
Methylcyclohexane	1.5
Octane	1.2

	ASC/16035.006 Potassium permanganate IBC (mgm^{-3})
Benzene	1.4
Toluene	0.42
Ethyl benzene	0.06
m,p-Xylene	0.07
o-Xylene	0.04
2-Methylbutane	0.20
Pentane	0.25
2-Methylpentane	0.14
Hexane	0.22
Heptane	0.47
Diethyl sulphide	0.23
Methylcyclohexane	0.26
Octane	0.40
Nonane	0.13
Phenol	0.30

APPENDIX 3 – FLARING AND COLD VENTING VOLUMES

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Rathlin Energy (UK) Ltd
West Newton 1
Well L46/05-3
Summary Page

Dia (ft): 0.31901

DATE	TIME minutes	Average Flow scf/d	Gas Volume scf	Cumulative Gas scf	Incinerated Gas scf	Cold Vented Gas scf	Vent %	Pipe Flowrate cf/s	Pipe Velocity ft/s
10/09/2014	393	37341	10000	10000	8375	1625	16%	0.28	3.54
13/09/2014	105	45581	4000	14000	3289	711	18%	0.24	2.95
18/09/2014	105	322124	23000	37000	19988	3012	13%	1.79	22.34
TOTAL			**37000**		**31652**	**5348**	**14%**		

Rathlin Energy (UK) Ltd
West Newton 1
Well L46/05-3

DATE	TIME	Choke 64th	WHP psig	WHT degF	UcP psig	UcT degF	DcP psig	DcT degF	AannP psig	BannP psig	GasSG	instant QChkgi scf/d	cummla ChkgCum scf	Pipe Flowrate cf/s	Dia (ft) 0.31901 Pipe Velocity ft/s	Venting Fla	Vent Vol scf
10/09/2014	10:20:00	0	199.45	71.14	201.7	69.06	5.24	69.57	2035.85	415.33	0.676	0	0	0.00	0.00	0	0
10/09/2014	10:21:00	16	200.27	71.27	203.13	69.17	0.74	69.7	2035.85	415.33	0.726	309000	0	3.46	43.34	0	0
10/09/2014	10:22:00	20	196.18	71.38	195.15	69.32	2.38	69.81	2035.85	415.53	0.726	457000	1000	4.63	57.94	0	0
10/09/2014	10:23:00	20	173.69	71.42	175.33	69.42	71.89	69.76	2035.85	415.73	0.726	411000	1000	0.82	10.25	0	0
10/09/2014	10:24:00	20	156.31	71.36	155.09	69.51	36.31	69.71	2035.85	415.53	0.726	363000	1000	1.23	15.38	0	0
10/09/2014	10:25:00	20	135.46	71.25	137.1	69.52	25.48	69.6	2035.85	415.73	0.726	321000	1000	1.38	17.26	0	0
10/09/2014	10:26:00	20	122.38	71.06	120.95	69.54	21.8	69.46	2035.85	415.73	0.726	283000	1000	1.34	16.75	0	0
10/09/2014	10:27:00	20	106.43	70.88	106.43	69.47	19.55	69.25	2035.85	415.73	0.726	249000	2000	1.26	15.70	0	0
10/09/2014	10:28:00	20	94.37	70.68	93.55	69.42	17.3	68.97	2035.85	415.53	0.726	219000	2000	1.18	14.78	0	0
10/09/2014	10:29:00	20	83.13	70.45	81.9	69.32	15.05	68.7	2035.85	415.53	0.726	192000	2000	1.11	13.93	0	0
10/09/2014	10:30:00	24	72.09	70.23	71.48	69.22	13.83	68.43	2039.12	415.53	0.726	238000	2000	1.44	18.00	0	0
10/09/2014	10:31:00	24	55.32	70.03	56.55	69.11	24.86	68.16	2038.92	415.53	0.726	188000	2000	0.82	10.24	0	0
10/09/2014	10:32:00	24	43.47	69.79	42.45	68.95	19.75	67.94	2041.78	415.73	0.726	141000	2000	0.71	8.82	0	0
10/09/2014	10:33:00	24	31.82	69.58	31.2	68.78	14.24	67.7	2042.6	415.53	0.726	104000	2000	0.62	7.74	0	0
10/09/2014	10:34:00	24	20.98	69.35	22.62	68.63	10.15	67.57	2042.6	416.35	0.726	75000	2000	0.52	6.50	0	0
10/09/2014	10:35:00	24	16.89	69.15	16.07	68.51	7.69	67.44	2046.07	416.35	0.726	54000	3000	0.42	5.20	0	0
10/09/2014	10:36:00	24	9.74	68.99	11.17	68.35	5.44	67.36	2046.69	416.35	0.726	37000	3000	0.32	3.96	1	51.38889
10/09/2014	10:37:00	24	9.94	68.89	12.4	68.22	11.99	67.41	2046.89	416.35	0.726	41000	3000	0.26	3.31	1	56.94444
10/09/2014	10:38:00	24	10.56	68.9	14.03	68.17	14.24	67.59	2049.75	418.19	0.726	47000	3000	0.28	3.50	1	65.27778
10/09/2014	10:39:00	24	13.62	68.98	15.87	68.12	15.66	67.91	2049.55	418.39	0.726	53000	3000	0.30	3.76	0	0
10/09/2014	10:40:00	24	13.83	69.05	17.92	68.17	17.71	68.18	2049.55	418.39	0.726	60000	3000	0.32	3.99	0	0
10/09/2014	10:41:00	24	17.51	69.15	19.75	68.13	19.55	68.33	2049.55	418.39	0.726	66000	3000	0.33	4.16	0	0
10/09/2014	10:42:00	24	17.51	69.26	21.6	68.17	21.8	68.45	2049.75	418.6	0.726	72000	3000	0.34	4.25	0	0
10/09/2014	10:43:00	24	20.78	69.37	23.23	68.19	23.43	68.62	2049.55	418.6	0.726	77000	3000	0.35	4.36	0	0
10/09/2014	10:44:00	24	21.6	69.48	22.41	68.25	16.07	68.81	2049.55	418.39	0.726	75000	3000	0.42	5.26	0	0
10/09/2014	10:45:00	24	20.78	69.6	22.21	68.35	22.01	69.01	2049.75	418.6	0.726	74000	3000	0.35	4.35	0	0
10/09/2014	10:46:00	24	21.39	69.73	22.82	68.44	23.02	69.22	2049.75	418.39	0.726	76000	3000	0.35	4.35	0	0
10/09/2014	10:47:00	24	21.39	69.85	23.23	68.54	23.23	69.48	2049.75	418.39	0.726	77000	3000	0.35	4.39	0	0
10/09/2014	10:48:00	24	17.92	70	19.14	68.65	16.48	69.76	2049.55	418.6	0.726	64000	3000	0.35	4.44	0	0
10/09/2014	10:49:00	24	17.92	70.16	19.96	68.75	19.75	70.01	2049.55	419.01	0.726	67000	3000	0.34	4.21	0	0
10/09/2014	10:50:00	24	18.33	70.29	20.98	68.84	20.98	70.23	2049.75	419.01	0.726	70000	3000	0.34	4.25	0	0
10/09/2014	10:51:00	24	18.33	70.44	22.01	68.98	22.01	70.38	2049.55	418.8	0.726	73000	3000	0.34	4.30	0	0
10/09/2014	10:52:00	24	18.94	70.6	22.01	69.1	21.8	70.5	2047.3	419.21	0.726	73000	3000	0.35	4.33	0	0
10/09/2014	10:53:00	24	19.75	70.73	21.8	69.21	20.98	70.54	2046.69	419.01	0.726	73000	3000	0.35	4.43	0	0
10/09/2014	10:54:00	24	19.55	70.84	21.8	69.31	20.98	70.52	2046.69	419.01	0.726	73000	3000	0.35	4.43	0	0
10/09/2014	10:55:00	24	19.96	70.95	21.6	69.41	20.98	70.55	2046.69	419.01	0.726	72000	3000	0.35	4.37	0	0
10/09/2014	10:56:00	24	19.96	71.05	21.6	69.49	20.98	70.72	2046.69	419.01	0.726	72000	3000	0.35	4.37	0	0
10/09/2014	10:57:00	24	20.57	71.2	21.6	69.62	20.98	70.93	2046.69	418.8	0.726	72000	4000	0.35	4.37	0	0
10/09/2014	10:58:00	24	20.57	71.32	21.6	69.73	20.98	71.15	2046.69	419.01	0.726	72000	4000	0.35	4.37	0	0
10/09/2014	10:59:00	24	20.78	71.46	21.8	69.84	21.8	71.38	2046.69	419.01	0.726	73000	4000	0.35	4.34	0	0
10/09/2014	11:00:00	24	20.78	71.58	23.64	70.01	23.02	71.59	2044.64	419.01	0.726	79000	4000	0.36	4.54	0	0
10/09/2014	11:01:00	24	24.46	71.7	27.11	70.13	25.07	71.76	2045.05	418.8	0.726	90000	4000	0.39	4.91	0	0
10/09/2014	11:02:00	24	25.07	71.82	28.34	70.28	26.3	71.93	2045.05	419.01	0.726	94000	4000	0.40	4.97	0	0
10/09/2014	11:03:00	24	36.11	71.95	38.77	70.38	32.23	72.04	2045.25	418.8	0.726	129000	4000	0.48	5.96	0	0