

## **APPENDIX 3 – OVERVIEW OF CHEMICAL USE AND DISCHARGE**

### Introduction and background

This assessment is intended to describe the range of cementing chemicals to be used during the P and A of the Athena production and water injection wells and the P and A of previously suspended Athena well, in Block 14/18b together with their uses and potential for environmental effects. It is not as a substitute for the risk assessment which will form part of the applications for term permits under the *Offshore Chemical Regulations 2002* for chemical use and discharge (PON15B) to be submitted for each well, to the Department of Energy and Climate Change (DECC) in due course.

### Regulatory background

All chemicals to be used in the P and A operations of the Athena wells will be subject to applications under the *Offshore Chemical Regulations 2002* for a Chemical Term Permit (PON15B). The term “offshore chemical” in this context includes naturally occurring materials and products composed of one or more substances.

The *Offshore Chemicals Regulations 2002* implement the OSPAR Decision (2000/2) and Recommendations (2000/4 and 2000/5) introducing a Harmonised Mandatory Control System for the use and reduction of the discharge of offshore chemicals across the OSPAR area. Decision 2000/2 requires that offshore chemicals must be pre-screened and ranked according to their calculated Hazard Quotients. A Hazard Quotient (HQ) is the ratio of Predicted Environmental Concentration (PEC) to Predicted No Effect Concentration (PNEC). Authorities within the OSPAR area are required to use the CHARM (Chemical Hazard Assessment and Risk Management) “hazard assessment” module as the primary tool for ranking chemicals. Chemicals undergo a harmonised testing regime for their biodegradation, bioaccumulation potential and toxicity. The process facilitates the substitution of chemicals or components of chemicals by less hazardous alternatives.

### REACH

REACH (the Regulation, Evaluation, Authorisation and Restriction of Chemical Substances) implements EC 1907/2006 and came into force on 1<sup>st</sup> June 2007, with provisions being phased in over 11 years from this date. REACH provisions give greater responsibility to industry to manage the risks from chemicals and manufacturers and importers have to gather information on the properties of their chemical substances and register the information on a central database to be maintained by the European Chemicals Agency.

### Pre-screening

At present, in the UK, the Offshore Chemical Notification Scheme (OCNS) is administered by DECC with scientific advice from the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and Marine Scotland, Aberdeen. The OCNS uses the OSPAR Harmonised Mandatory Control Scheme (HMCS) developed through the OSPAR Decision 2002/2 and its supporting Recommendations. All chemicals which are used in the exploration, exploitation and associated offshore processing of petroleum on the UK Continental Shelf offshore must be notified. The updated listing of chemicals currently notified and approved for use may be referenced from the CEFAS website ([www.CEFAS.co.uk](http://www.CEFAS.co.uk)).

Some chemicals, in particular inorganic materials, are not amenable to calculation of an HQ using CHARM. These chemicals are classified in OCNS ‘Groups’ based on their potential biodegradation,

bioavailability and toxicity to a range of marine plants and animals. There are a number of OCNS groups into which a chemical can be categorised, groups A to E. Group A represents the greatest potential hazard and Group E the least. The environmental properties of products composed entirely of substances on the OSPAR PLONOR list (OSPAR List of substances/Preparations Used and Discharged Offshore, which **Pose Little Or No Risk** to the Marine Environment) are considered sufficiently well known that the UK regulatory authorities do not require them to be tested further. Any product deemed PLONOR is automatically placed in OCNS group E.

The requirements of REACH are ultimately expected to replace those of the HMCS for evaluating the environmental impacts of chemicals used and discharged offshore. However as the new Regulations will take several years to fully implement, the HMCS approach to regulating the use and discharge of offshore chemicals will be maintained for the foreseeable future.

Chemicals containing components identified as Candidates for Substitution appear on OSPAR prescribed lists, or have either a biodegradation value of less than 20% in 28 days or a combination of two of the following three properties:

- I. Bioaccumulation potential ( $\log Pow \geq 3$ )
- II. Biodegradation <70 % in 28 days (OECD 301A, 301E) or <60 % in 28 days (OECD 301B, 301C, 301F, 306)
- III. Where single substance toxicity data is provided, a toxicity value of <10mg/l

Ithaca would only propose the use of chemical containing substances which are Candidates for Substitution where the function was critical and where no alternative is available.

Some chemicals can also be given taint or other warnings labels. Taint is defined as the ability of a substance to impart a foreign flavour or odour to the flesh of fish and shellfish and is only likely to result following prolonged and regular discharges of tainting substances. Low concentrations of heavy metals and persistent organic compounds in chemical components also result in warning labels. There are no regulatory requirements to minimise the use of chemicals flagged with taint warnings, heavy metals or persistent organic compounds although discharge of products containing substances known to be endocrine disrupters is not allowed. As part of the Term Permit applications process, Ithaca will identify all chemicals which may be subject to such warnings and, wherever possible, choose alternative chemistries.

#### Risk assessment of actual use and discharge

CHARM is also the accepted method of assessing the potential for effects associated with the proposed use and discharge of chemicals in specific operations. Chemicals are individually risk assessed using the proposed actual usage and discharge amounts and modes, current regime, water depth etc. All chemicals are included, whether intended for **essential use** or as a **contingency** (i.e. only used in specific circumstances to address specific during drilling issues/problems). The CHARM model is used calculate a Risk Quotient (RQ) for each chemical (PEC:PNEC). The RQ is an indication of the likelihood of adverse effects occurring due to the use and discharge of a chemical. A chemical discharge which generates an RQ of below 1 (i.e. the Predicted Environmental Concentration is less than the Predicted No Effect Concentration) is deemed to be unlikely to result in a significant effect on the marine environment. Should a predicted chemical discharge result in an RQ over 1, Ithaca would aim, where possible, to remove the chemical from the operation or change the discharge route.

#### Athena decommissioning programmes chemical requirements

In order to begin decommissioning of Athena, a number of different activities involving the P and A of wells and the removal of the FPSO and associated subsea infrastructure needs to be carried out, all of which will involve the use and discharge of chemicals. Below is an indicative description of chemicals used during the decommissioning.

#### Chemicals associated with decommissioning activities

##### Well Kill chemicals

The wells, all of which will be killed with inhibited brines containing a number of different chemicals including a biocide and corrosion inhibitor, prior to P and A

Brines are water-based solutions of inorganic salts used as a well control fluid. They are solids free and do not contain any particles that may plug or damage a producing formation. Salts within the brine can inhibit undesirable formation reactions such as clay swelling and common salts used in the preparation of simple brine systems include sodium chloride, calcium chloride and potassium chloride.

In addition to chemicals used for well P and A, the rig will also utilise other chemicals such as rig washes to ensure a clean, safe working environment onboard.

##### Cementing chemicals

Cementing chemicals are used to provide the necessary barriers to prevent hydrocarbons escaping from the well. The cement mixture is injected down into the casing and a plug inserted above it. During routine cementing operations there are usually minimal discharges of cementing chemicals.

##### Other well related chemicals

Chemicals used for other/additional uses include, rig washes, hydraulic fluids and pipe dopes. Rig wash use is essential during P and A programmes to maintain a clean and safe working area. Pipe dopes are applied to the tubing-pipe and tool joints each time a connection is made to prevent thread galling and to seal the roots of threads. Hydraulic fluid is required to operate the Blow-Out Preventer.

#### Assessment Criteria

The following tables contain a qualitative assessment of potential chemical use and discharge for the Athena decommissioning.

Each chemical which may be used has been assessed on its composition and likely fate in the marine environment, HQ Band/OCNS group, warning labels and whether they contain components identified as suitable for substitution.

## Indicative Chemical Assessment

### Drilling fluids

#### Essential Use chemicals

| Chemical                | Chemical Application   | Chemical Composition and Properties   | Where used   | Chemical label code | HQ |
|-------------------------|--|---|--|---------------------|----|
| M-I BAR                 | Weighting material used to increase the density of a liquid drilling fluid system for well control purposes. | Barium sulphate. Naturally occurring mineral, insoluble in seawater, with very low bioavailability and toxicity.                | Used in 36", 17½", 12¼" and 8½" (prod well only) sections. | PLONOR              | E  |
| Calcium Chloride        | Weighting material used to increase the density of a liquid drilling fluid system for well control purposes. | Calcium chloride, naturally occurring completely soluble in water. Not hazardous to the environment and does not bioaccumulate. | Used in the 36" section only                               | PLONOR              | E  |
| Calcium Chloride Powder | Weighting material used to increase the density of a liquid drilling fluid system for well control purposes. | Calcium chloride, naturally occurring completely soluble in water. Not hazardous to the environment and does not bioaccumulate. | Used in the 12¼" and 8½" (prod well only) sections         | PLONOR              | E  |

Contingency Use chemicals

| Chemical                       | Chemical Application  | Chemical Composition and Properties   | Where used  | Chemical label code | HQ   |
|--------------------------------|---|---|---|---------------------|------|
| M -I BAR                       | Weighting material used to increase the density of a liquid drilling fluid system for well control purposes.                        | Barium sulphate. Naturally occurring mineral, insoluble in seawater, with very low bioavailability and toxicity.  | Contingency chemical used in all hole sections.                                 | PLONOR              | E    |
| LIME                           | Component of drilling fluid system. Aids well control during drilling operations.   | Calcium Hydroxide. Rapidly naturalised by absorption of CO <sub>2</sub> . Not expected to bioaccumulate within sediments and non toxic to marine organisms.                   | Contingency use in 36" section.   | PLONOR              | E    |
| Mica                           | Additive used to control fluid losses to the formation during drilling operations.  | Silica(SiO <sub>2</sub> ), Alumina (Al <sub>2</sub> O <sub>3</sub> ) & Potash (K <sub>2</sub> O). Natural rock mineral, insoluble with very low bioavailability and toxicity. | Contingency chemical used in all hole sections.                                 | PLONOR              | E    |
| NUTPLUG                        | Additive used to control fluid losses to the formation during drilling operations.  | Cellulose – Nutshells. Insoluble, natural organic product. Refractory and slow to biodegrade. Non toxic to marine organisms.  | Contingency chemical in all hole sections.                                      | PLONOR              | E    |
| Sodium Bicarbonate             | Material used to increase the density of a liquid drilling fluid system for well control purposes.                                  | Sodium Bicarbonate. Soluble inorganic compound. Rapidly dispersed in seawater. Readily biodegradable and non-hazardous to marine systems.                                     | Contingency chemical in all hole sections.                                      | PLONOR              | E    |
| DynaRed™ Seepage Control Fiber | Material used to control circulation.   | Details of components not disclosed: proprietary. Chemical is slightly soluble in water and expected to be readily biodegradable and non-toxic to marine organisms.           | Contingency chemical used in 17½", 12¼" and 8½" (prod well only) hole sections. | PLONOR              | E    |
| Calcium Chloride Powder        | Weighting material used to increase the density of a liquid drilling fluid system for well control purposes.                        | Calcium chloride, naturally occurring completely soluble in water. Not hazardous to the environment and does not bioaccumulate.   | Used in the 12¼" and 8½" (prod well only) sections                              | PLONOR              | E    |
| CONQOR 404                     | Corrosion inhibitor used to prevent corrosion of the casings exposed to suspension fluid. Essential for maintaining well integrity. | Phosphate Ester. Soluble in water, not expected to bioaccumulate. Readily biodegradable and non toxic to marine organisms.  | Used in the 12¼" and 8½" (prod well only) sections                              | -                   | Gold |
| Sugar                          | Thinner used in the drilling fluid system   | Naturally occurring substance. Very soluble in water, readily biodegradable not considered toxic to marine organisms.   | Used in the 12¼" and 8½" (prod well only) sections                              | PLONOR              | E    |

## Cementing Chemicals

### Essential use chemicals

| Chemical                                      | Chemical Application   | Chemical Composition and Properties   | Where used                                     | Chemical label code | HQ   |
|---|--|---|--|---------------------|------|
| Calcium Chloride Powder                       | Used to control fluid weight for well control purposes   | Calcium Chloride, naturally occurring, soluble and not expected to bioaccumulate.                         | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| 77% Calcium Chloride S1                       | Additive used to control fluid losses to during cementing operations.  | Calcium Chloride, naturally occurring, soluble and not expected to bioaccumulate.                         | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| AccuSET D197                                  | Component in cement mixture  | Inorganic acid salt compound. Soluble in water and low toxicity.  | Chemical used in cement mix for fixing casings | -                   | Gold |
| Antifoam Agent D175                           | Antifoam (Hydrocarbons) component in cement mix, used to reduce foaming  | Dimethyl siloxanes + silicones + sorbitan stearate. Dispersible in water not biodegradable.               | Chemical used in cement mix for fixing casings | SUB                 | Gold |
| Antisidimentation Agent B18                   | Cement or cement additive  | Amphorus silica. Dispersible in water and is expected to be non-toxic                                     | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Anti-Settling Agent D153                      | Cement or cement additive  | Crystalline silica. Partly soluble in water and is expected to be non-toxic                               | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| BARITE D31                                    | Additive used in the cement mixture to increase the density  | Barium sulphate. Naturally occurring mineral, insoluble in water, low bioavailability and toxicity        | Chemical used in cement mix for fixing casings | -                   | E    |
| Bentonite Extender D20                        | Additive used as weighting material to increase density  | Bentonite, naturally occurring, insoluble clay mineral with very low bioavailability and toxicity         | Chemical used in cement mix for fixing casings | -                   | E    |
| Cement Class C D903                           | Cement or cement additive  | Portland cement, miscible with water. Expected to be non-toxic.   | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Cement Class G D907                           | Mixed with water and additives and placed in annulus of well. Set cement will give support to the casing, isolate any producing formations and minimize corrosion of the casing from subsurface waters | Portland cement. Mixture of naturally occurring insoluble minerals with low bioavailability and toxicity. | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| D095 Cement Additive                          | Controls the loss of cement slurry to the formation  | Inert fiber. Insoluble in water, low toxicity   | Used to fix casings                            | PLONOR              | E    |
| D600G GASBLOK* Gas Migration Control Additive | Component in the cement mixture  | Aromatic polymer. Disperses in water, not readily biodegradable and does not bioaccumulate.               | Chemical used in cement mix for fixing casings | SUB                 | Gold |
| Dye B275                                      | Used as a tracer dye in cement slurries or spacers   | Ethane-1,2-diol, Acetic acid. Soluble in water, does not bioaccumulate and is readily biodegradable.      | Within mix for fixing casings                  | -                   | Gold |

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| Chemical                                 | Chemical Application   | Chemical Composition and Properties  | Where used                                     | Chemical label code | HQ   |
|--|--|--|--|---------------------|------|
| Environmentally Friendly Dispersant B165 | Dispersant used to reduce viscosity of the cement slurry. Allows coarse slurries to be pumped with reduced pipe friction | Aromatic polymer derivative. Soluble in water, biodegradable and not expected to bioaccumulate   | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Fluid Loss Control Additive D193         | Additive used in cement mixture to control fluid loss.   | Organic polymer, Hexahydro-1,3,5-tris (2-hydroxyethyl)-sym-triazine). Soluble in water, is not expected to bioaccumulate and is biodegradable                    | Chemical used in cement mix for fixing casings | -                   | Gold |
| GASBLOK* LT D500                         | Cement or cement additive  | Organic polymer, amine polymer hexahydro-1,3,5-tris (2-hydroxyethyle)-sym-triazine. Soluble in water, low bioaccumulation potential, not likely to bioaccumulate | Chemical used in cement mix for fixing casings | SUB                 | Gold |
| Liquid Antifoam B143                     | Cement or cement additive  | Rapeseed oil. Dispersible in water. Readily biodegradable  | Chemical used in cement mix for fixing casings | -                   | Gold |
| Liquid Retarder D81                      | Cement or cement additive  | Calcium lignosulfonate. Soluble in water, not likely to bioaccumulate  | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Litefil* D124 Extender                   | Component in cement mixture  | Aluminium silicate. Insoluble in water, low toxicity   | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Mutual Solvent U66                       | Used to enhance the performance of the chemicals in the cementing mixture  | 2-Butoxyethanol. Miscible in water, readily biodegradable, low bioaccumulation potential.  | Chemical used in cement mix for fixing casings | -                   | Gold |

### Contingency use chemicals

| Chemical                      | Chemical Application   | Chemical Composition and Properties  | Where used                                     | Chemical label code | HQ   |
|-------------------------------|--|--|--|---------------------|------|
| Calcium Chloride Powder       | Used to control fluid weight for well control purposes                     | Calcium Chloride, naturally occurring, soluble and not expected to bioaccumulate.                  | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| 77% Calcium Chloride S1       | Additive used to control fluid losses to during cementing operations.      | Calcium Chloride, naturally occurring, soluble and not expected to bioaccumulate.                  | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| AccuSET D197                  | Component in cement mixture  | Inorganic acid salt compound. Soluble in water and low toxicity.                                   | Chemical used in cement mix for fixing casings | -                   | Gold |
| Antifoam Agent D175           | Antifoam (Hydrocarbons) component in cement mix, used to reduce foaming    | Dimethyl siloxanes + silicones + sorbitan stearate. Dispersible in water not biodegradable.        | Chemical used in cement mix for fixing casings | SUB                 | Gold |
| Antis sedimentation Agent B18 | Cement or cement additive  | Amphorus silica. Dispersible in water and is expected to be non-toxic                              | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Anti-Settling Agent D153      | Cement or cement additive  | Crystalline silica. Partly soluble in water and is expected to be non-toxic                        | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| BARITE D31                    | Additive used in the cement mixture to increase the density of the mixture | Barium sulphate. Naturally occurring mineral, insoluble in water, low bioavailability and toxicity | Chemical used in cement mix for fixing casings | -                   | E    |

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| Chemical                                      | Chemical Application   | Chemical Composition and Properties   | Where used                                     | Chemical label code | HQ   |
|---|--|---|--|---------------------|------|
| Cement Class C D903                           | Cement or cement additive  | Portland cement, miscible with water. Expected to be non-toxic.   | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Cement Class G D907                           | Mixed with water and additives and placed in annulus of well. Set cement will give support to the casing, isolate any producing formations and minimize corrosion of the casing from subsurface waters | Portland cement. Mixture of naturally occurring insoluble minerals with low bioavailability and toxicity.                                     | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| D095 Cement Additive                          | Controls the loss of cement slurry to the formation  | Inert fiber. Insoluble in water, low toxicity   | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| D600G GASBLOK* Gas Migration Control Additive | Component in the cement mixture  | Aromatic polymer. Disperses in water, not readily biodegradable and does not bioaccumulate.   | Chemical used in cement mix for fixing casings | SUB                 | Gold |
| Dye B275                                      | Used as a tracer dye in cement slurries or spacers   | Ethane-1,2-diol, Acetic acid. Soluble in water, does not bioaccumulate and is readily biodegradable.  | Chemical used in cement mix for fixing casings | -                   | Gold |
| Environmentally Friendly Dispersant B165      | Dispersant used to reduce viscosity of the cement slurry. Allows coarse slurries to be pumped with reduced pipe friction   | Aromatic polymer derivative. Soluble in water, biodegradable and not expected to bioaccumulate  | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Fluid Loss Control Additive D193              | Additive used in cement mixture to control fluid loss.   | Organic polymer, Hexahydro-1,3,5-tris (2-hydroxyethyl)-sym-triazine). Soluble in water, is not expected to bioaccumulate and is biodegradable | Chemical used in cement mix for fixing casings | -                   | Gold |
| Litefil* D124 Extender                        | Component in cement mixture  | Aluminium silicate. Insoluble in water, low toxicity  | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Mutual Solvent U66                            | Used to enhance the performance of the chemicals in the cementing mixture  | 2-Butoxyethanol. Miscible in water, readily biodegradable, low bioaccumulation potential.   | Chemical used in cement mix for fixing casings | -                   | Gold |
| Silica Flour D66                              | Cement additive designed to reduce settling tendencies in lightweight slurries as well as controlling free water.  | Crystalline silica. Insoluble in water, does not bioaccumulate.   | Chemical used in cement mix for fixing casings | PLONOR              | E    |
| Surfactant D191                               | Cement or cement additive  | Alcohol ethoxylate propoxylate. Dispersible in water readily biodegradable, not expected to bioaccumulate.                                    | Chemical used in cement mix for fixing casings | -                   | Gold |

Other chemicals, including rig chemicals and well clean-up chemicals required for Athena

Essential use chemicals

| Chemical | Chemical Application | Chemical Composition and Properties | Where used | Chemical label code | HQ |
|----------|----------------------|-------------------------------------|------------|---------------------|----|
|----------|----------------------|-------------------------------------|------------|---------------------|----|



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|                             |  |   |                                   |        |      |
|-----------------------------|--|---|-----------------------------------|--------|------|
| Bestolife "3010"®NM Special | Pipe dope applied to the drill-pipe too joints each time a connection is made. This substance prevents galling and seals the roots of the threads  | Amorphous and synthetic graphite. Naturally occurring mineral insoluble in water. Believed to be non-toxic to marine organisms  | Used in drilling operations       | -      | E    |
| Emulsotron CC3362-G         | Chemical that breaks up emulsions, foams and aids separation   | 2-butoxyethanol. Soluble in water. Not expected to bioaccumulate and is biodegradable   | Used in drilling operations       | SUB    | Gold |
| Emulsotron DE7190           | Chemical that breaks up emulsions, foams and aids separation   | 2-butoxyethanol. Soluble in water. Not expected to bioaccumulate and is biodegradable   | Used in drilling operations       | -      | Gold |
| Monoethylene Glycol         | Chemical for use in surface pressure testing on wells.   | Monoethylene glycol. Organic material, miscible with water, readily biodegradable and will not adsorb to suspended solids or sediments. It is not expected to bioaccumulate and is non toxic. | Used in drilling operations       | PLONOR | E    |
| Potassium Chloride Brine    | Brine used during well completion and suspension   | Potassium Chloride. Naturally occurring, soluble in water, not expected to bioaccumulate and is biodegradable   | Used for well suspension          | PLONOR | E    |
| RIGGER-2                    | Detergent/cleaning fluid essential for maintaining a clean work place during drilling operations   | Ethoxylated fatty alcohol (C9-11), ethoxylated coc-alkyl amines. Soluble in seawater, biodegradable, no bioaccumulation potential and negligible toxicity                                     | Used tin drilling operations      | SUB    | Gold |
| Safe-Cide                   | Biocide used to prevent fouling  | 2,2',2''-(Hexahydro-1,3,5-Triazine-1,3,5-Triyltriethanol), Ethylendiaminetetraacetic acid. Miscible with water, not bioaccumulating and readily biodegradable                                 | Used in drilling operations       | -      | Gold |
| Safe-Cor 220X               | Chemical used to prevent corrosion   | Components not listed. Miscible with water, is biodegradable and not bioaccumulating  | Used in drilling operations       | -      | Gold |
| Safe Scav NA                | Chemical used to scavenge oxygen   | Ammonium bisulphite and water. Miscible with water, not expected to bioaccumulate   | Used in drilling operations       | PLONOR | E    |
| Sodium Chloride             | Used for surrounding methanol tanks for fire-fighting assistance   | Sodium Chloride. Naturally occurring, water soluble, biodegradable  | Used for fire-fighting assistance | PLONOR | E    |
| Sodium Chloride Brine       | Brine used during well completion and suspension   | Sodium Chloride. Naturally occurring, water soluble, biodegradable  | Used in drilling operations       | PLONOR | E    |
| Stack Magic ECO-F           | Hydraulic fluid required for the BOP. As the BOP valve is usually operated remotely by hydraulic actuators, this fluid is essential for operations | Polyoxyethylene glyceryl ether compounds with ethanolamine fatty acids C6-12, ethylene glycol. Soluble in seawater, biodegradable, no bioaccumulation potential and negligible toxicity       | Used in drilling operations       | -      | D    |

## Chemicals in existing appraisal wells

| Chemical                 | Chemical Application                             | Chemical Composition and Properties  | Where used               | Chemical label code | HQ   |
|--------------------------|--|--|--------------------------|---------------------|------|
| Potassium Chloride Brine | Brine used during well completion and suspension | Potassium Chloride. Naturally occurring, soluble in water, not expected to bioaccumulate and is biodegradable  | Used for well suspension | PLONOR              | E    |
| Safe Scav NA             | Chemical used to scavenge oxygen                 | Ammonium bisulphite and water. Miscible with water, not expected to bioaccumulate  | Used for well suspension | PLONOR              | E    |
| Safe-Cide                | Biocide used to prevent fouling                  | 2,2',2''-(Hexahydro-1,3,5-Triazine-1,3,5-Triyltriethanol), Ethylenediaminetetraacetic acid. Miscible with water, not bioaccumulating and readily biodegradable | Used for well suspension | -                   | Gold |
| Safe-Cor 220X            | Chemical used to prevent corrosion               | Components not listed. Miscible with water, is biodegradable and not bioaccumulating   | Used for well suspension | -                   | Gold |
| Sodium Chloride Brine    | Brine used during well completion and suspension | Sodium Chloride. Naturally occurring, water soluble, biodegradable   | Used for well suspension | PLONOR              | E    |

*Note: The above table represents an indicative suite of chemicals which can be used during the drilling and completion operations of the Athena Development. If the certification of any chemical used is due to expire during operations, Ithaca will ensure that either the chemical supplier is applying for re-certification of the product, or an alternative chemical is identified and used. No expired chemicals will be used.*

Estimated essential P&A and cementing chemical use and discharge (these quantities are the estimated total per well)

| Chemical  | Estimated chemical use and discharge |                    |
|---|--------------------------------------|--------------------|
|   | Use (tonnes)                         | Discharge (tonnes) |
| <b>Cementing Chemicals</b>                                  |                                      |                    |
| Calcium Chloride Powder                                     | 6                                    | 2                  |
| 77% Calcium Chloride S1                                     | 6                                    | 2                  |
| AccuSET D197  | 21                                   | 4                  |
| Antifoam Agent D175   | 2                                    | 1                  |
| Antisedimentation Agent B18                                 | 7                                    | 4                  |
| Anti-Settling Agent D153                                    | 1                                    | <1                 |
| BARITE D31  | 9                                    | 3                  |
| Bentonite Extender D20                                      | 6                                    | 1                  |
| Cement Class C D903   | 227                                  | 36                 |
| Cement Class G D907   | 2411                                 | 418                |
| D095 Cement Additive  | 7                                    | 1                  |
| D600G GASBLOK* Gas Migration Control Additive               | 19                                   | 9                  |
| Dye B275  | 1                                    | <1                 |
| Environmentally Friendly Dispersant B165                    | 8                                    | 3                  |
| Fluid Loss Control Additive D193                            | 7                                    | 3                  |
| GASBLOK* LT D500  | 12                                   | 6                  |
| Liquid Antifoam B143  | 2                                    | 1                  |
| Liquid Retarder D81   | 3                                    | 1                  |
| Litefil* D124 Extender                                      | 10                                   | 1                  |
| Mutual Solvent U66  | 1                                    | <1                 |
| <b>Other chemicals (including well clean-up and brines)</b> |                                      |                    |
| Bestolife "3010" ®NM Special                                | 1                                    | 1                  |
| Emulsotron CC3362-G   | <1                                   | <1                 |
| Emulsotron DE7190   | <1                                   | <1                 |
| Methanol  | 2                                    | 2                  |
| Monoethylene Glycol   | 6                                    | 6                  |
| Potassium Chloride Brine                                    | 7                                    | 7                  |
| RIGGER-2  | 10                                   | 10                 |
| Safe-Cide   | 1                                    | 1                  |
| Safe-Corr 220X  | 2                                    | 2                  |
| Safe Scav NA  | 1                                    | 1                  |
| Sodium Chloride Brine                                       | 23                                   | 23                 |
| Stack Magic ECO-F   | 10                                   | 10                 |

### Suspension chemicals in existing appraisal well

| Chemical                 | Estimated use (tonnes) | Estimated discharge (tonnes) |
|--------------------------|------------------------|------------------------------|
| Potassium Chloride Brine | 180                    | 180                          |
| Safe Scav NA             | 1.0                    | 1.0                          |
| Safe-Cide                | 1.0                    | 1.0                          |
| Safe-Corr 220X           | 2.0                    | 2.0                          |
| Sodium Chloride Brine    | 360                    | 360                          |

## Assessment of Chemical Use and Discharge

As stated above, this assessment is not intended as a substitute for the risk assessments which will form part of the applications for a Term Permit under the *Offshore Chemical Regulations 2002* for chemical use and discharge (PON15B) during the drilling and completion of the development wells, or the application for a chemical permit (PON15D) for the chemicals required during routine operations. All relevant permits will be submitted to DECC in due course.

It does give a good indication of the likely chemicals which are to be used and discharged during the Athena decommissioning programmes and well P&A activities. The majority of chemicals to be used are PLONOR listed or carry no warning labels.

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