

Notice of request for more information

The Environmental Permitting (England & Wales) Regulations 2016

Angus Energy Weald Basin No.3 Limited

Westpoint 4 Redheughs Rigg
South Gyle
Edinburgh
Scotland
EH12 9DQ

Application number: EPR/BL9763IN/V005

The Environment Agency, in exercise of its powers under paragraph 4 of Part 1 of Schedule 5 of the above Regulations, requires you to provide the information detailed in the attached schedule. The information is required in order to determine your application for a permit duly made on 10/03/2021.

Send the information to either the email or postal address below by 16 August 2021. If we do not receive this information by the date specified then we may treat your application as having been withdrawn or it may be refused. If this happens you may lose your application fee.

Email address: psc@environment-agency.gov.uk.

Postal address:
Permitting and Support Centre
Quadrant 2
99 Parkway Avenue
Parkway Business Park
Sheffield
S9 4WF

Name	Date
Eleanor Blackeby	19/07/21

Authorised on behalf of the Environment Agency

Notes

These notes do not form part of this notice.

Please note that we charge £1,200 where we have to send a third or subsequent information notice in relation to the same issue. We consider this to be the second notice on the issues covered in this notice.

The notes in italics that appear after questions in the attached schedule do not form part of the notice. The notes are intended to assist you in providing a full response.

Schedule

Supplementary Hydrogeological Risk Assessment (SLR Ltd, 422.07154.00002, Rev 6, August 2020) (Supplementary HRA)

1. Confirm whether the procedure set out in your response to question 2 of the first Schedule 5 Notice applies to all sources of produced water for injection.

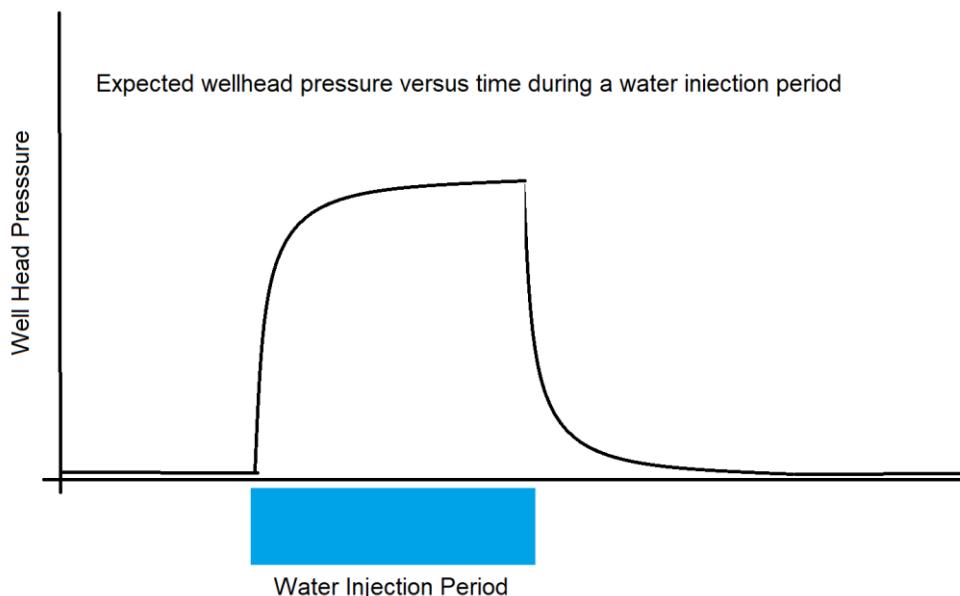
In the previous Schedule 5 you were asked to provide supporting documents for all relevant procedures and monitoring systems referenced as 'robust procedures' in section 2.2. We note there is now a proposal to check 'Lidsey' produced water upon first injection and then repeat the compatibility check on a 6 monthly basis. It is not clear if this applies to the other sources of produced water.

BRO-ANGPR-O0004-3 has been amended to refer to "any imported water from a new source".

2. Explain how you propose to reconcile the frequent well head pressure readings against the monthly bottom hole pressure readings. You should provide calculations in support of your response.

In response to question 3 of the first Schedule 5 Notice you explained that water injection well head pressures are to be monitored every 30 minutes during injection. We expect there to be a clear calculation as to what this means for bottom hole pressure during daily injection. If measurement of bottom hole pressure itself will only be done monthly, we would expect the daily calculation to be recorded and regularly calibrated against the bottom hole measurements to confirm assumptions about how the reservoir behaviours remain valid.

The monitoring of pressure during injection is to measure the transient short-term effects of injection on the wellhead pressure of the injection well. Within a short time after injection this pressure will fall away as per the diagram below. The purpose of this monitoring is to ensure that wellhead pressure remains within acceptable limited during injection.



In terms of bottom hole pressure the maximum bottom hole pressure during injection is directly proportional to the surface pressure applied. So 100 psi of additional pressure at surface would result in a maximum of 100 psi extra bottom hole pressure (ignoring frictional losses which would tend to reduce the latter).

The difference between the static bottom hole pressure of around 1096 psi (measured in 2021 and to be derived monthly from echometers) and the formation breakdown pressure, at the injection depth, of 1635 psi (a higher estimate of the fracture pressure being 2060) is 529 psi. Therefore up to 529 psi could be applied at surface with no impact on the formation. However, we have included a safety margin in our planning so a maximum wellhead pressure of 350 psi is being used.

The data recording will therefore be as follows:

- A. Previous month's echometer reading of downhole pressure: (say) 1096 psi
- B. Well head injection pressure during 30 minute injections: (limit) 350 psi
- C. A+B must be less than C, lower limit of breakdown pressure: 1635 psi

Updating the monthly echometer to provide a new estimate of downhole pressure not only validates the graph above but also acts as a failsafe to the risk of overpressure as well as a warning sign of any unforeseen trends.

- 3. Provide further information about the potential observational error mentioned at the end of your response to question 5 (paragraph 1) of the first Schedule 5 Notice to aid our understanding of the situation.

In your response you stated "the pressure presently is about (1096psia measured in 2021) reflecting a very small pressure difference which may be observational error or reflects the small movement of water into the oil reservoir".

The results of the original water zone well test in the Brockham 1 well showed a pressure of 954 psia at a depth of 647.78m below rotary table.

The water injection well is completed at a depth of 754m. The expected pressure difference between these two observation points would be 0.465 psi/ft or 1.5256psi/m of depth difference. Based on the observed original test pressure and correcting to the depth of the injection well the original pressure at that depth would have been 1116psi. The recent observed pressure was 1096psi which is around 20psi difference which is within experimental error.

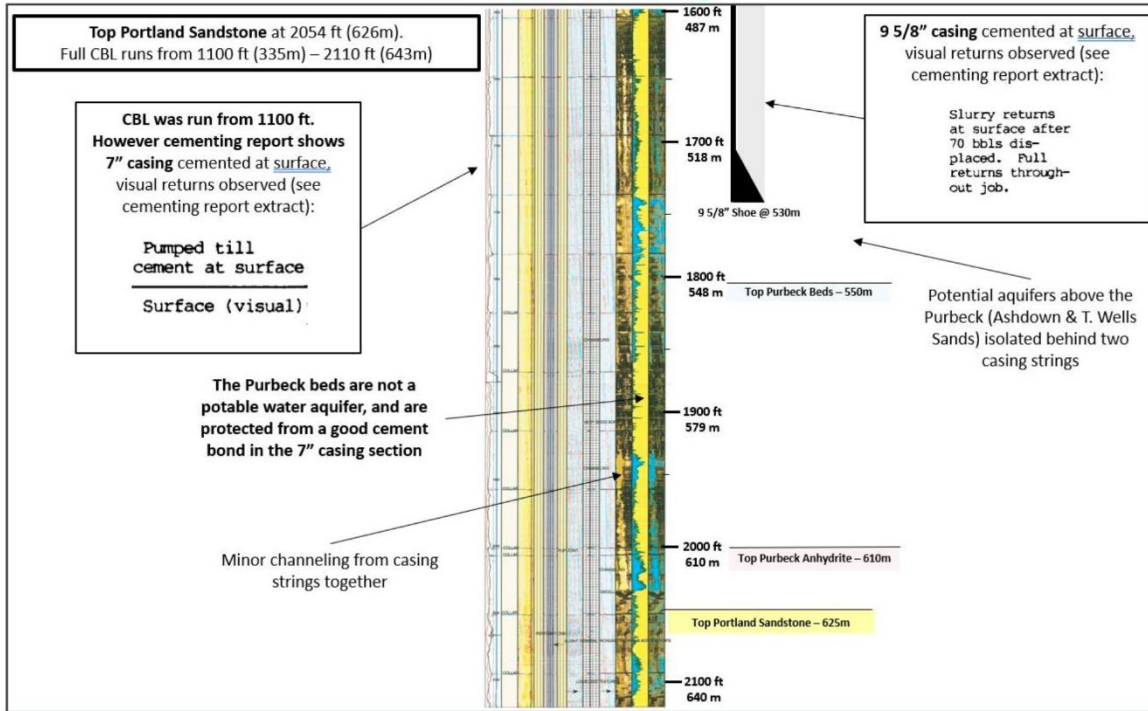
- 4. Provide a more detailed evaluation of the poorer cement bond that has been identified between 550m to 530m BGL. Consideration should be given to any additional risk this poses to the surrounding formations. Please note we have identified a discrepancy between figure 2.5 of the supplementary HRA (v 7 – June 21) and figure 3 in the Schedule 5 Response in terms of the geology that's being shown at 530m to 550m. You should confirm which figure is correct.

The section 530m to 550m corresponds to a 20m section immediately below the 9 5/8ths inch casing shoe. The imperfect cement bond is usual just below casing shoes because on drilling out of the shoe the hole size is usually larger and more irregular making achieving a perfect cement bond harder. Having said that there is cement present as evidenced by the formation returns seen (signal that has passed through casing and cement to the formation and echoed back the same way). This means there is some bond between the casing and the formation via the cement it is just not perfect.

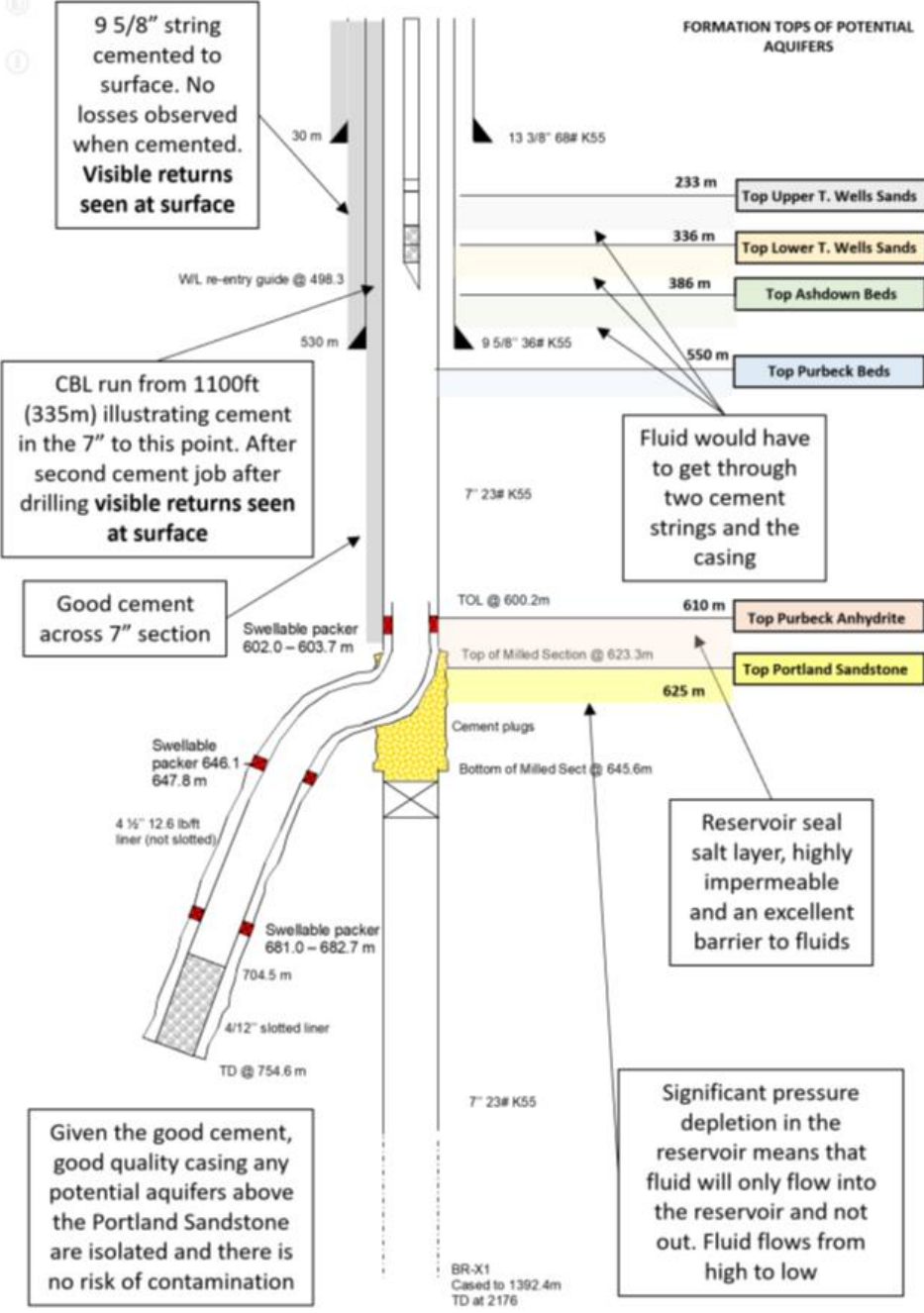
In evaluating this short section of poorer cement bond, we draw attention to the fact that the formation alongside this section is composed of mudstones and shales of Lower Cretaceous age. This formation is impermeable which is why it was selected for the casing shoe. So any fluid present in the well could not enter the formation at this point - even if it were able to pass through the tubing into the annulus and through the casing and the cement.

The vertical barriers of good cement above and below are more than adequate to prevent any annular flow upwards behind casing from the reservoir to the saline aquifers above. This short section of imperfect cement is immaterial to the overall cement barrier. As regards the discrepancy in geology, we reproduce the two figures here, but are unable to see any discrepancy in the descriptions of interval between 530m (casing shoe depth) and 550 m (Purbeck Tops) where the cement bond is poorer.

Figure 2-5
2003 USIT Cement Bond Log



- ①
- ②
- ③
- ④
- ⑤



NOT TO SCALE

Appendix 08 – Surface Water Monitoring and Discharge (BRO-ANGPR-00024-2)

5. Revise or replace the site plan at the end of document BRO-ANGPR-0024-1 (page 182 of the pdf) to ensure it shows more detailed information such as the drainage paths across the site and location of penstocks.

The plan should enable an operative to identify key features of the drainage system as described in the document text. The site plan in isolation provides limited information regarding surface water monitoring and discharge. Note: apologies for the typographical error in the first Schedule 5 notice. The above referenced document was incorrectly referenced as BRO-ANGPR-0024-1

BRO-ANGPR-00024-2 has been amended to include updated drawing. The new document reference is now BRO-ANGPR-00024-3

