# North Eigg Development Right Scoping Feedback

Key Lessons for the upcoming North Eigg HPHT Exploration well

North Eigg Well Delivery Team
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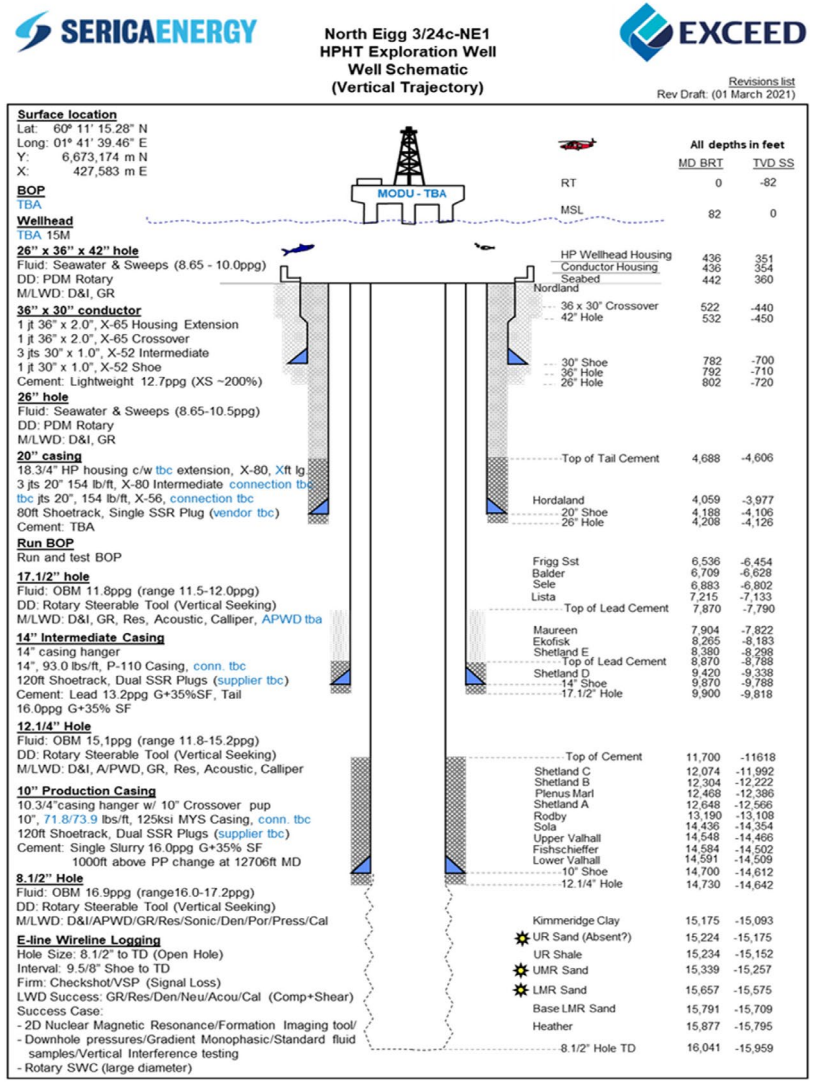
#HPHTexploration #casingdesign

# Well Scope Summary

North Eigg Concept – Serica Energy

**Overview:**

- The North Eigg prospect (100% Serica) in Block 3/24c of the UKCS Northern North Sea, and the proposed well design is based largely on the casing design used on the Rhum production wells 3/29a-5 and 3/29a-6 drilled in 2004/2005 with a semi-submersible rig. The third production well in the Rhum field 3/29a-4, drilled in 2000 with a semi-submersible, as an appraisal well subsequently converted to a production well in 2005. The converted appraisal well had minor technical compromises not related to drilling design issues but production issues, however the later production wells (-5 & - 6) were an engineered solution that addressed the production load case issues realised with the converted appraisal well design.
- The North Eigg HPHT exploration well design is based on a low-cost, fit for purpose ‘finder’ well concept, i.e., a bare-bones well programme with clearly defined well objectives to establish the presence of hydrocarbon deposits. The ‘finder’ exploration costs are minimised by limiting data gathering to LWD and E-line logging, with no requirement for either conventional coring, well testing or an option geological sidetrack. There is no planned reuse of the exploration well at a later stage, therefore the well will be abandoned on completion of the data acquisition phase.
- The well design is a standard four string full casing scheme with the reservoir section to be drilled in an 8.1/2” hole size. Conductor, surface casing, intermediate casing, and production casing. The requirement for a drilling liner was deemed significantly unlikely and the option has been discounted. The offset wells demonstrate that if the prognosed formations come in on prognosed depths and at the prognosed PPFG conditions then the well may be successfully drilled with a Rhum lookalike design. There is a high confidence in the subsurface prognosis based on geological similarity of the offset wells.



# Challenges: Wells and casing Design

| Design Challenge | Session Feedback |
|---|---|
| 26” Hole / 20” Casing Setting Depth – What experience do other Operators have in successfully drilling and casing off deep (~4100ft TVDss) surface casing shoes with a semi-sub rig? | General consensus was that drilling deep to enable a higher shoe strength was correct given relatively good offset experience. Riserless Mud Recovery (RMR) was discussed as an option but the forum recognized that it may be expensive to implement for a 1-well campaign. Weighted sweeps can also be used which is similar to a pseudo mud weight whilst drilling open water. Tubular running equipment should be carefully selected to allow washing of the string to bottom if possible. |
| Intermediate Casing (API P110 Non-Sour Service) - H2S in the 12.1/4” section is not prognosed, being an exploration well albeit with what is considered analogous close offset data, are there any concerns with the use of API P110 casing material? | Based on offset information, the design being exploration based, and no plans for well test, consensus was that non-sour service intermediate casing was appropriate. Further measures such as scavengers in mud were also discussed, which will also be required anyway for non-sour rated workstrings. Sour service intermediate casing has been specified from some of the operators in the room for development wells with known sustained casing pressure in the B-Annulus. |
| Production Casing - What measure do other Operators take to assure that the H2S partial pressure and pH values are accurate to allow the selection of high yield strength sour service casing material? | For production casing, generally these calculations are supported by dedicated materials and chemistry departments or consultants. H2S partial pressure calculations as shown in the pre-read looked satisfactory. An opportunity to look at using fugacity as a calculation (requiring specialist materials/chemistry support, as well as a prognosis of production fluids in case of a kick) was raised which generally shows a lower requirement for sour service capability given a set of pressure/temperature/production fluid compositions. |
| Flexible Cement (12.1/4” hole x production casing) - A “Finder” well that should not subject the cement behind the production casing to large and multiple pressure/temperatures that can create a micro-annulus, is there a requirement for flexible cement? | Operators reached consensus that for an exploration well with no development requirements or well test, that flexible cement was unlikely to be required. |
| Design Factors - In casing design there are typical “standard” load cases and “extreme” load cases. An example of an extreme loads for a subsea well is a blowout scenario where the well has unconstrained flow for a period before being capped and then cools down. Do other Operators use different design factors for “standard” and “extreme” loads? | Rather than reducing design safety factors, discussion was focused around digging into the design inputs for the “extreme loads” and running more realistic inputs. Examples include using more realistic pressures/temperatures rather than maximum cases or making modifications to fluid gradients in the exterior/interior of the casing. Reliability based design has also been used previously to model these cases rather than reduce the design factors. If a required design factor genuinely cannot be achieved based on the above approach(es) then a risk assessed deviation/MOC process can be used to demonstrate the risk is ALARP. |
| Production Casing Pressure Test - In exploration drilling, for the production casing string do other Operators perform (a) a limited pressure test to ensure no gross make up error of casing or (b) pressure test to full displacement to gas plus a bullhead margin? | General support to reduce the pressure test requirement if not necessarily due to the heightened risk of damaging well components but would need risk assessment and potentially be raised with the HSEx and well examiner. |
| Abandonment - What experience do other Operators have of cutting and pulling both the intermediate and production casings from inside the 20” shoe with 1000ft combination plug set on the casing stumps a potential time saving strategy? | This is a reasonably deep 20” shoe. Provided the barrier depth is compliant with the UKO&G guidelines regarding fracture gradient versus pore pressure projected upwards on the fluid gradient then this is certainly a good starting point for considering this as an acceptable approach |

# Additional Notes / Feedback

- It was stressed that a clear objective for a finder well only was set in stone to ensure the right scope for the well design is carried. Any uncertainty on whether the well was exploration and logging only vs keeping the door open for future development or well test may incur significantly increased costs over the functional scope.
- Setting of the 20” casing at ~4000ftTVDss was supported and feedback given with respect to that regarding rig selection, fluids and pump capacities etc. Other feedback regarding rig selection included to recognise the importance and many benefits of a warm rig with HPHT experience.
- A contingency design was discussed and recommended in case of an additional hole size requirement such as a 7-5/8” drill-in liner or a slimhole design.
- Operator stock sharing for either relief well materials or contingency materials was discussed as an opportunity to reduce waste across the basin. A consignment deal would allow ordering of contingency materials or sharing of materials with other operators.
- It was recommended that analysis on wellhead loading and fatigue modelling, including riser analysis is performed as early as possible once the MODU was selected (or a ‘first-pass’ once a likely rig(s) is known) due to potential delays or issues that arise.
- A risk highlighted by the group is the plan to drill an HPHT well without MPD which is becoming rarer. Rig start-up will be key as well as HPHT specific training practices.
- Early HSEx engagement was recommended due to the HPHT nature of the well. Other operators have had good experience in ensuring the HSEx were involved earlier on in the process to highlight specific issues or focus areas that they may want to prepare for in advance of a Well Notification. Early engagement with BEIS/OGA will also be important to start early due to the HPHT nature of the well.