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Title:

Halliburton Verification Report

Document number: SHRK-PGNiG-S-RA-0126

Contents list

Abbreviations

Abbreviations	
BEP	Best Environmental Practice
BSS	Baroid Surface Solutions
DD	Directional Driller
DSN	Deepsea Nordkapp
ECD	Equivalent Circulating Density
HSEQ	Health Safety Environment Quality
HOCNF	Harmonised Offshore Chemical Notification Format
LAA	Limited Assignment Agreement
LWD	Logging While Drilling
MRR	Mud Recovery without Riser
MWD	Measurement While Drilling
NPT	Non-Productive Time
OBM	Oil Based Mud
P&A	Plug and Abandonment
PSL	Product Service Line
RAP	Rig Action Procedure
ROP	Rate of Penetration
RUG	Risikoutsatte Grupper
SDS	Safety Data Sheet
WBM	Water Based Mud

1 Introduction

1.1 Executive Summary

Following this year's planned Shrek exploration well for PGNiG, a verification of Halliburton mud, cement, mudlogging, MWD/LWD/DD, bit, coring and BSS services was performed to ensure a high level of quality and commitment to deliver a first-class performance for the Shrek well. Focus for the verification has been on operational preparedness, personnel competence, implementation of lessons learnt and environmental compliance.

No non-conformities were found, 2 improvement suggestions and 16 follow up actions were registered.

Reference is made to the notification sent 12th June 2019 with regards to the joint verification of Halliburton between PGNiG, DNO and Well Expertise.

The verification was conducted 20th June 2019 at Halliburton premises in Tananger.

1.2 Verification Objective

The main objectives of the verifications were:

- Verify that Halliburton operational preparedness and technical expertise is in accordance with Well Expertise's frame agreement with Halliburton, limited assigned to PGNiG and DNO for the duration on the wells (limited assigned agreement, LAA)
- To perform PGNiG and DNO's see-to duty of Halliburton with regards to the Shrek and Canela wells, respectively
- Confirming that Halliburton management system and organization is in accordance with PGNiG, DNO and Well Expertise's expectations with regards to robustness and HSEQ follow up

1.3 Participants

Role	Name	Position	Company
Verification Lead	Øystein Prytz	Senior Drilling Engineer	Well Expertise
Auditor (BSS and coring for Canela)	Grethe Lønø	Senior Drilling Engineer	DNO
QHSE Auditor	Anne Mork	Senior QHSE Advisor	Well Expertise
Environmental Auditor	Christina Sæland Rødne	Environmental Advisor	Well Expertise

Auditor	Steinar Aarnes	Drilling Engineer	Well Expertise
Auditee	Kent A. Dahle	Well Expertise Account Manager	Halliburton
Auditee	Rolf M. Kristensen	Sr Advisor Quality and Process Execution	Halliburton
Auditee	Rafael Rosales	DD operations lead	Halliburton
Auditee	Hans Harald Berge	SDL Technical Advisor	Halliburton
Auditee	Tonje Hetland	Cementing contract responsible	Halliburton
Auditee	Chero Nuri	Drill Bits Application Engineer	Halliburton
Auditee	Monika Kolecka	Performance Development Coordinator	Halliburton
Auditee	Finn Norman Lode	Coring and Drill Bits Contract Responsible	Halliburton
Auditee	Kjetil Geelmuyden	Service Coordinator Cement	Halliburton
Auditee	Khahlil Rehman	Cementing Operational Team Lead	Halliburton
Auditee	Kathrine Kirkebøe	HSEQ – Regulatory Affairs Offshore Chemicals	Halliburton
Auditee	Ingrid Viste	Cementing Onshore Engineer	Halliburton
Auditee	Renate Dysvik	Baroid Contract Responsible	Halliburton
Auditee	Duncan Clinch	Baroid Technical Manager	Halliburton
Auditee	Espen Evjenth	Coring Manager	Halliburton
Auditee	Odd_Steinar Harkestad	BSS, Technical Professional	Halliburton

Auditee	Per-Magnus Skretting	BSS Coordinator	Halliburton

2 Findings

2.1 Deviations

Verification performed according to plan.

2.2 Warrant

The verification is warranted in the Shrek Verification Plan and the Well Expertise Audit Plan for 2019.

The verification is based on PGNiG supplier risk assessment and Well Expertise's service supplier criticality matrix which requires a verification of Halliburton services prior to start-up of the Shrek operation.

2.3 Non-conformances

There were no non-conformances registered during the verification.

2.4 Improvement suggestions

Item	Description	Suggestion
1	There is no database to support transfer of lessons learned from project to project.	Halliburton should evaluate to set up a data base which makes it possible to transfer lessons learned from project to project.
2	Update Measurement Program, ref. Id. 3.1.	Christina Rødne (Well Expertise) Ingrid Viste/Renate Dysvik (Halliburton)

2.5 Follow up actions

Item	Actions	Responsible for follow up
1	Halliburton – CVs for coordinators and offshore personnel to be sent to PGNiG/WE	Anne Mork (Well Expertise)
2	Halliburton Cement – software issue with electrical batch mixer	Stig Seland (Well Expertise) Ingrid Viste (Halliburton)
3	Odfjell – Missing remote operated valves on 2 cement silos	Stig Seland (Well Expertise)
4	Halliburton Cement – 1 of the 6 planned cement operators does not have the qualifications of running downhole tools. To be followed up.	Øystein Prytz (Well Expertise) Kjetil Geelmuyden (Halliburton)
5	Halliburton Mud – Current work bench to be upgraded to steel bench, fire proof chemical cabinet needed	Stig Seland (Well Expertise) Nicole Reppert (Halliburton)
6	Halliburton Mud/Odfjell/Aker BP – Internet and phone issue	Stig Seland (Well Expertise) Nicole Reppert (Halliburton)
7	Odfjell/Halliburton Mud – Volume sensors in some tanks and pits are out of calibration	Stig Seland (Well Expertise) Nicole Reppert (Halliburton)
8	Odfjell/Halliburton mud – Only one hose in loading station common for OBM and WBM transfers from boat	Stig Seland (Well Expertise) Nicole Reppert (Halliburton)
9	Odfjell/Halliburton mud – Shelves for screen storage is being planned, screens are currently being stored on pallets on the floor	Stig Seland (Well Expertise) Nicole Reppert (Halliburton)
10	Halliburton mud/PGNiG – Halliburton does not have the inhouse expertise to qualify the mud for finger printing. PGNiG to explain how this will be done, what characteristics are acceptable etc.	Øystein Prytz (Well Expertise) Nicole Reppert (Halliburton)

11	Halliburton mud – 20/80 W/O ratio: Slightly compromised sag stability might be indicating in testing. Check if acceptable with Halliburton mud.	Øystein Prytz (Well Expertise) Nicole Reppert (Halliburton)
12	Halliburton mudlogging/Odfjell/Aker BP – Currently no phones in the DCR	Stig Seland (Well Expertise) Hans Harald Berge (Halliburton)
13	Halliburton mudlogging/Odfjell – Experienced some unexpected loss of power in the technical room during maintenance	Stig Seland (Well Expertise) Hans Harald Berge (Halliburton)
14	Halliburton mudlogging/Odfjell – Rig signal for Flow Out and Density Out is missing	Stig Seland (Well Expertise) Hans Harald Berge (Halliburton)
15	Halliburton DD/MWD/LWD/Odfjell – BHAs are made on the main rotary; aux has not enough height	Øystein Prytz (Well Expertise) Sergio Barrak (Halliburton)
16	Halliburton to send substitution plan 2019 to PGNiG/WE	Christina Rødne (Well Expertise) Kathrine Kirkebøe (Halliburton)

The follow up actions and improvement suggestions are transferred to the PUN 2019 Audit, Review and Verification Register, stored on Projectplace for further follow up: https://service.projectplace.com/pp/pp.cgi/r1588228898.

2.6 Scope of work with answers and comments (PGNiG)

Id.	Reference	Finding	
1.0	**Presentation of PGNiG/Shrek well, DNO/Canela well and Well Expertise. Current Status.**		
1.1	Intro	Øystein Prytz and Kent Allan Dahle.	
Halliburton Drilling Fluids and Cement verification 20th June 2019			
2.0	**PGNiG/DNO/WE verification of Halliburton Service Delivery**		
2.1	Support	Halliburton to do a quick summary of Halliburton Management System with focus on HSEQ reporting and implementation of lessons learnt. Halliburton to also present Halliburton statistics and performance on NCS and Deepsea Nordkapp (DSN) and Island Innovator (INN) in particular.	
	Halliburton answer/comment	Halliburton management system (HMS) includes a Code of business conduct, policies and business practices, standards, process maps and working method. Halliburton Norway are ISO 9001:2015, 14001:2015 certified. The company is registered in Achilles and EPIM JQS. The company is divided in product service lines (PSL) both on global and local level. Each PSL has a Quality plan. HSE offshore program developed yearly. Specific QA plan and HSE plan are established upon customer request according to contract. Lessons learned are accessible in SharePoint and best practice database available for all employees/PSL on a global level. Each PSL use different tools for experience transfer and lessons learned. However, there are no database to support transfer of lessons learned from project to project. As of 1.1.2018 Halliburton has implemented a new system for HSE statistics called Power BI. There is a possibility that this solution can be available for both offshore and client in the future. No registered LTI for the period 1.1.18 - today. Statistics for DSN: No LTI and zero incident for the period 10th- 31th of May	
2.2	Personnel	Halliburton to do a quick summary of: • Selection of personnel to support PGNiG/Well Expertise for the Shrek well. • Relevant competence and training. • Assurance that the Coordinators are following the Shrek project through.	
	Halliburton answer/comment	Halliburton specific competence requirements for DD were shown as an example. Halliburton ensured all personnel working with the Shrek project have the required Halliburton	

		internal competence. CVs for coordinators to be sent to PGNiG/Well Expertise	
3.0	**WE verification of Halliburton HSE and Environmental (Cement and Mud Services)**		
3.1	Chemical Management	REACH: Are all Halliburton chemical components of individual products registered? Are all SDS' in accordance with REACH? Explain process for ensuring that chemicals and cement on rig meets specification of laboratory tests. Measurement program; Please provide updated measurement programs for mud and cement Update frequency? It is expected that all Halliburton chemicals on Deepsea Nordkapp have updated SDS. How do Halliburton secure that all chemicals taken onboard are registered in the rig's system (EcoOnline), in binders in storage and hospital? Please verify. How to ensure that no non-approved chemicals enter the rig? Routines for ensuring compliance with AfD (remove Aker BP chemicals). Please provide your procedures for these two cases.	
	Halliburton answer/comment	REACH: All chemicals are REACH registered. This is dealt with on a global basis and is carried out by the Halliburton global REACH team. The team has registered substances Halliburton need to register as a company and also has the overview over the substances and products where Halliburton are downstream users. All SDSs are in accordance with REACH. The database "EcoOnline" is used for all chemicals in Norway. Kiwa Teknologisk Institutt (before Teknologisk Institutt) used to produce all SDSs for Halliburton in Norway, but this is done on a global basis now. Therefore, there are some older SDSs, but they are valid. Have not set a date when all chemicals have new versions. All offshore chemicals requiring HOCNF has this in place. HOCNFs are developed on the basis of the requirements within OSPAR and the Norwegian Activities Regulation, and SKIM HOCNF guideline. The Manager of Regulatory Affairs Offshore Chemicals has a database. An updated Measurement program was not provided because there has not been any changes (version 2013). WE/PGNiG encourage Halliburton to update it. The program was not known to relevant parties. The measurement program is applicable for all discharges to sea, and shall:	

		• Describe and justify chosen methods / frequencies to determine emissions • Describe the different steps involved in the determination of emissions (flow measurements, sampling, analysis and calculations) • Describe procedures for quality assurance Updated SDS: Implemented HMS site that list Halliburton Process for Registration of Chemicals. This included customer requirements. Ref. "Customer Registration"- New chemicals in Halliburton Norway HMS system. Work method WM-NO-HAL-ENV-021 "Registration of chemical in customer databases and approval of chemicals offshore". Each PSL is responsible for entering chemicals in Halliburton customers' systems, which including rig systems. Chemicals: Develop Solution PM-GL-HAL-BAR-100. Also, all coordinators have a technical checklist, which includes chemical management All chemicals shall be backloaded when starting a new operation. Common products like Barite and Bentonite may stay on the rig to ease logistic and reduce transport costs. An excel spreadsheet called "Wellsight" is filled out before backloading. "Wellsight" is also the reporting system used for chemical usage and discharge in operation. Each coordinator is responsible for compliance with AfD.	
3.2	BAT practise and development of new chemicals	Please summarize ongoing work on development of new chemicals used in Halliburton and replacement strategy of Yellow (Y2) chemicals.	
	Halliburton answer/comment	Substitution plan for 2019. General information is detailed in process map for update of the plan, ref. PM-NO-HAL-ENV-003 Halliburton Substitution Plan for Wellbore Chemicals (Offshore Portfolio). At the moment there are two cementing chemicals ready for substitution, Halad 300 -> Halad-500 and SCR-100->SCR-200. These will not be used on the Shrek operation. The most dangerous chemicals (black and red categorized) where substituted once the requirement of such plan was implemented. The Y2 products that is in the portfolio now must have Y2 properties to meet technical safety issues. This is most common for cement chemicals and biocides.	
3.3	Working Environment	WE request that a plan/date for the working environment mapping is established. Please verify.	

		Have Halliburton performed a working environment /WEAC mapping of the unit? How do Halliburton ensure familiarity with rig and continuity of personnel to reduce risk of spill to sea? Is health risk assessment for chemicals planned used on Deepsea Nordkapp done? (General or rig specific assessments?)	
	Halliburton answer/comment	Halliburton perform RUG inspections (risk exposed groups) on a regular basis on all rigs. A 5 days WEA offshore inspection planned for week 26.	
3.4	HSEQ General	Please present Halliburton's system for follow up of incidents and non-conformances, both HSE and Quality related. How to avoid spill to sea. Please provide with internal procedure or proposed procedure for operation on Deepsea Nordkapp.	
	Halliburton answer/comment	Halliburton presented the system for follow up of incident and non-conformances.	
4.0	**WE verification of Halliburton Cementing**		
4.1	Cement operations onboard Deepsea Nordkapp	Explain main issues on Deepsea Nordkapp today for cementing operations such as chemical storage, working environment, logistics, cement dust from cement operations, etc Explain how the cement is transferred from the cement silo to the cement unit throughout a cement job. List if any general problems with rig air, plugged lines or crane operations. Present Halliburton Cement's performance and non-productive time on Deepsea Nordkapp so far. Present reasons and statistics for the rig. Halliburton to demonstrate benefits and synergy effect of using both cement and mud services from same company. Examples: Minimize displacement interface, share chemicals, mud/cement compatibility, etc.	

	Halliburton answer/comment	Halliburton explained that there are no problems with regards to noise, dust or pressure. 6 cement jobs have been performed. Software issue regards to slurry density experienced when using Electrical batch mixer, but no batch mixer planned for the Shrek operations. To be followed up. There are 4 x 80 m^3 cement silos and the bulk is transferred from the silos to the steady flow bin. Only two silos can be used during cement job, since only two silos have remote operated valves. Installation of remote operated valves for the two last cement silos is planned by Odfjell. To be followed up. The benefits with having Halliburton providing both mud and cement services are easy access to required data and samples for testing (fluid properties and compabilities) and sharing chemical stock offshore.	
4.2	Equipment and Chemicals	Please share experience on Deepsea Nordkapp with operation of cement head, reliability of the cement head and type used. Recommend technology for future operations on Deepsea Nordkapp. Cement stand on Deepsea Nordkapp, are Halliburton delivering cement stand to current operations? The P&A cementing operations require either a cement stand or a cement swivel. Please recommend what should be used for the Shrek operations. Please highlight any potential risks for the planned cement job on Shrek with respect to Halliburton equipment and rig and 3rd party interfaces (crossover for Dril-Quip running tool, foam cement job for topholes etc). Please prepare a logistics plan for volumes and chemicals. PGNiG/WE plan on sending a spud vessel from Tananger and will be able to carry premix and chemicals north. Supply base under operations will be in Kristiansund. Please comment if backup float equipment and shoetracks from previous wells managed by Well Expertise are usable for Shrek well Will cement and chemicals from the Skogul operations be backloaded?	

	Halliburton answer/comment	Commander cement head has been tested on the rig but not used yet (planned for Rumpetroll 9 5/8" job). No problems experienced during test. Commander cement head will be used on Shrek for 9 5/8" job. Cement stand on DSN is currently delivered by Odfjell. Halliburton can deliver cement stand for Shrek. Halliburton recommends cement swivel for P&A cement plugs. Halliburton mentioned allocation of deck space for foam equipment during tophole drilling must be planned in advance. B/U float equipment was checked the following day after the verification and verified ok by Halliburton (21.06.19) The plan is to backload all bulk cement from Skogul operations.	
4.3	QA / QC	Please verify internal procedure for having cement recipe ready in case shallow gas incident during drilling of pilot hole.	
	Halliburton answer/comment	Cement slurry will be tested and recommendation including slurry recipe will be submitted prior to drilling pilot hole. Chemicals will be mobilized to rig as a contingency. Early load out is recommended to obtain relevant samples for testing.	
4.4	Personnel competency	Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify. Halliburton to provide PGNiG/WE with CV's for crew. Are the cement crews on Deepsea Nordkapp today trained in using down hole equipment including bridge plugs, storm valves etc? Explain current requirements for cementers to operate down hole equipment.	
	Halliburton answer/comment	Plan to use existing crew from DSN	

		1 of the 6 planned cement operators does not have the qualifications of running downhole tools. To be followed up. Class room exercises twice a year and on the job training is required by Halliburton for operations of downhole equipment.	
4.5	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	
	Halliburton answer/comment	It was mentioned the issue with able to only cement from two silos (remote operated valve not installed on two of the four silos). To be followed up.	
5.0	**PGNiG/WE verification of Halliburton Mud services.**		
5.1	Mud operations onboard Deepsea Nordkapp	Present main issues on Deepsea Nordkapp today for mud operations such as chemical storage, working environment, logistics, fumes in shaker room, etc Present BaraLogix experience of DSN so far and recommendation. Present Halliburton Mud's performance and non-productive time on Deepsea Nordkapp so far. Present reasons and statistics for the rig.	
	Halliburton answer/comment	Issues: • Current work bench to be upgraded to steel bench, fire proof chemical cabinet needed, to be followed up • Internet and phone issue, to be followed up. • Volume sensors in some tanks and pits are out of calibration, to be followed up • Only one hose in loading station common for OBM and WBM transfers from boat, to be followed up • Small sackstore, currently storing 11 LCM containers on deck • Shelves for screen storage is being planned, screens are currently being stored on pallets on the floor, to be followed up No experience with BaraLogix unit on DSN yet. Zero NPT for Halliburton Mud as of 20.06.19.	
5.2	Shrek Specific concerns	There is a risk for losses during drilling of the Shrek well, especially for the 12 ¼" section (Lower Naust Channel Complex). There is also a risk for swelling clays in 17 ½" resulting in that the mud system must be swapped out. What is the Halliburton proposed requirement for offshore and onshore backup volumes?	

		How is the drilling fluid mixed in Kristiansund controlled prior to be loaded onto PSV to ensure that it meets required drilling fluid specifications?	
	Halliburton answer/comment	No fracturing issues according to simulations, but experience from Skarv wells is tendency for shallower mud window than assumed. 10 m^3 of losses were experienced on Kvitungen Tumler during circulation, but was stratigraphically deeper. Shrek depth corresponds to setting depth of 13 3/8" which was ok. Halliburton recommendation for mud volumes is stated in the mud program. All mud is checked prior to be sent offshore. Mud checks are saved and referenced in Design of Service.	
5.3	QA/QC	Verify how mud programs and ECD calculations are QC'ed internally, especially for cold mud (17 ½" surface section on Shrek will be drilled with MRR and weighted mud). How can volume of slop be minimized? How is used mud finger printed, 3rd party? How can Halliburton assure used mud is suitable for Shrek? Less that 20% water content in the mud is requested in 8 ½" section to improve coring analysis. Halliburton to comment if this water level is feasible wrt mud performance.	
	Halliburton answer/comment	Mud programs and simulations are peer reviewed according to internal procedures and need to be approved prior to operations according to Halliburton. Riserless drilling is not very well simulated with Halliburton software, but Halliburton has a lot of experience with this type of drilling. Key Halliburton learnings with RMR/MRR: • GEM GP 3-5% v/v • 3 RPM: 4-10 lbs/100 ft^2 • Shaker screens: 140 • Beware of increase in MBT & Gels • Gumbo often observed with high ROPs>30 • High content of KCl Slop avoidance: • Avoid using excessive amounts of water	

		• Spot slops downhole under cmt plugs (P&A) instead of mud. Both financially and operationally beneficial. End of backloading higher volume of fluid • Slop unit on the DeepSea Nordkapp: Good feedback on slop treatment services performed onboard, treating 673 m3 in 11 days. AkerBP happy with performance. Finger-printing used mud: This has been performed by other customers in recent times to evaluate whether the amount of reservoir fluids contained within the drilling fluid are important. Further information on this procedure will need to be obtained as Halliburton does not have the inhouse expertise to qualify the mud for this purpose, to be followed up. 20/80 W/O ratio: Slightly compromised sag stability might be indicating in testing, but likely to be less important in (near) vertical well.	
5.4	Personnel competency	Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify. Halliburton to provide PGNiG/WE with CV's for crew.	
	Halliburton answer/comment	Scarabeo 8 crew will be transferred to DSN. CVs will be delivered for review.	
5.5	Test equipment	Halliburton to provide with checklist for standard laboratory equipment covered by contract and available on Deepsea Nordkapp. Slop needs to be tested for Flash point. Please verify if this is supplied by Halliburton.	
	Halliburton answer/comment	Equipment in accordance with WE contract. Flashpoint tester will be supplied. Equipment list presented in appendix.	
5.6	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	
	Halliburton answer/comment	None.	
6.0	**PGNiG/WE verification of Halliburton Mudlogging services.**		
6.1	Mud operations onboard Deepsea Nordkapp	Are there any issues regarding gas system, gas sensors or gas trap? Are the pit sensors working fine? Do they need to be repositioned to avoid false readings?	

		Who owns the depth encoder? Is there any backup system on the rig to track correct bit depth?	
	Halliburton answer/comment	No issues identified with gas system, gas sensors or gas trap. Pit sensors are provided by Odfjell and were moved to optimize performance at CCB yardstay. The depth system is provided by the rig.	
6.2	Quality	How is the track record on the data operators to react on a pit drill? It is important to be able to communicate correctly to the driller regarding unforeseen variations in the active pits while drilling. Please explain procedure.	
	Halliburton answer/comment	No experience on pit drill yet. Alarms set according to agreed upon Alarm Protocol, the driller to be notified immediately of any deviation, then investigate.	
6.3	Personnel competency	Is there a consistent crew that knows the rig setup and how to repair gas system, pit sensors and depth tracking system? Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify.	
	Halliburton answer/comment	Consistent crew on DSN and no plans to change them out.	
6.4	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	
	Halliburton answer/comment	• Currently no phones in the DCR, to be followed up • Experienced some unexpected loss of power in the technical room during maintenance – work is ongoing by Odfjell, to be followed up. • Rig signal for Flow Out and Density Out is missing, flagged to Odfjell / NOV, to be followed up. • Sperry Flow Out signal goes down slowly sometimes, due to the placement and mud backing up in the flow line	

7.0	**PGNiG/WE verification of Halliburton DD/MWD/LWD services.**		
7.1	DD/MWD/LWD operations onboard Deepsea Nordkapp	Are there any issues regarding M/U, racking of BHAs etc. experienced on Deepsea Nordkapp? Present Halliburton DD/MWD/LWD performance and non-productive time on Deepsea Nordkapp so far. Present reasons and statistics for the rig.	
	Halliburton answer/comment	No lessons learnt achieved. Problems making BHAs up in aux due to limited height, to be followed up with Odfjell.	
7.2	BHA design	All BHA's shall be made up in modules to optimize time spent building BHA's and minimize manual handling on drill floor. The pre made modules should include lifting subs. The subs and lifting sub in the modules shall be M/U with torque according to tool specifications and sign off forms shall be available on rig site. Make up / and break down procedures of all BHA's shall be handed to the drill crew by the directional driller well in advance of the operation included fish drawings of all items in the BHA's supplied by Halliburton.	
	Halliburton answer/comment	The modules are specified during the equipment preparation in the workshop and also shared with the customer, to optimize the handling offshore. All the drawings are delivered during the prejob briefing to the offshore engineers, which are shared with the rig crew prior to start the operation. All the provided diagrams contain where to break the BHA.	
7.3	Optimizing connection time.	Connection procedures including surveys shall be available at the rig site and part of the RAPs (Rig Action Procedures). The procedures should include what to do when surveys are not accepted by the QC (drill ahead / contact DSV).	
	Halliburton answer/comment	This will be part of RAP, DD coordinator will go through RAP with PGNiG/WE. Max distance between surveys is 100 m MD.	
7.4	Radioactive sources.	What procedures/regulations are Halliburton working by when handling radioactive sources on the rig? Track record, training of personnel, emergency response team.	
	Halliburton answer/comment	HMS has defined procedures and emergency plans for handling radioactive sources. Under MWD services: PM-GL-HAL-SD-MWD400. Halliburton has onshore emergency response team to help to handle incidents 24/7.	
7.5	Data quality	How to ensure that the correct data type and data rate is transmitted to the surface based on PGNiG geological requests.	

		What is the experience from DSN regarding RT data quality with wired pipe (easy / difficult to decode real time signals) and wired pipe setup in general?	
	Halliburton answer/comment	After the PGNiG delivers the requirements, Halliburton plans the data acquision setup for the MWD tools. During all the planning phase PGNiG will be contacted when necessary. There is no experience with wired pipe in Deepsea Nordkapp yet. Wired drillpipe will be run in the 8.5'' section on Rumpetroll.	
7.6	QA/QC	How do Halliburton ensure that the MWD tool flow rates are within PGNiGs request (drilling program)? How do Halliburton ensure that the sensor offset (gamma ray / resistivity) is within PGNiG request (drilling program)? How do Halliburton ensure that the procedures are followed / confirmed OK from when tools are ordered, made up in modules and sent to supply base for shipping out to rig? How is QA/QC of formation evaluation data and directional data performed?	
	Halliburton answer/comment	The flow rates in the planning phase are registered and Halliburton will request the tools to fit the agreed flow range. Halliburton measures the sensor distances in the Control Point #2 and the engineers offshore measure it against Control Point #2. Halliburton engineers are trained and follow the internal procedures to perform the job, according to internal policies and customers. Onshore team supervises and provide support to the offshore team when necessary Data QA/QC is handled by the offshore engineers, then verified by petrophysical group, survey management group and the coordinators that are involved in the operation.	
7.7	Personnel competency	What QA / QC system is present to ensure competency of personnel?	
	Halliburton answer/comment	See ID 2.2.	
7.8	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	
	Halliburton answer/comment	None.	
8.0	**PGNiG/WE verification of Halliburton BSS services.**		
8.1	BSS operations onboard	Please comment on the availability of skips for the Shrek well. How is the current setup on the rig? Have skip and ship been used on DSN or HCB tanks only (backup solution for	

	Deepsea Nordkapp	Shrek)? Is the system working OK, are the cuttings dry when entering tanks, jamming of cutting screws? Is the current setup a limiting factor on ROP? Please present track record of slop volume treated vs slop volume transferred back to shore. How can slop treatment be optimized?	
	Halliburton answer/comment	Agreements in place with four venders for delivery of skips, over 6000 skips in the marked for the applicable time period. Setup on DSN: • 2 x twin SV400 • 6 skip bay station • 6 HCB tanks (capacity 18 ton) • 1 slop unit with OIW analyzer • DE-1000 derrick centrifuge & pumps planned installed in July, to be followed up. Setup is flexible: two independent blowers, can blow to tank, to skips, from tank to skips or from tank to boat. No limitations on ROP expected: can handle 130 m/hr in 17 ½" section. Treated 673 m3 of slop in 14 days: 663 m3 of slops discharged to sea.	
8.2	QA / QC	How can we avoid spill to sea? How are the skips and HCB tanks certified and inspected prior to use?	
	Halliburton answer/comment	Closed loop system all the way to skip. Hard pipe, no hoses. Bund wall installed around equipment; drains are closed hazard drains. All the skips are built in accordance with NORSOK standard. The HCB tank have recently undergone a 5-year certification. DNV have approved installation of cuttings transport system. Slop unit and OiW analyzer completed annual EX certification, and Z-015 verifications completed.	
8.3	Personnel competency	Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify.	
	Halliburton answer/comment	Halliburton have six supervisors onboard DSN that are on fixed rotation.	
8.4	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	

	Halliburton answer/comment	None.	
10.0	**PGNiG/WE verification of Halliburton Coring services.**		
10.1	Coring operations onboard Deepsea Nordkapp	How are Halliburton ensuring that the most suitable coring BHA setup for Shrek is used? What experiences do Halliburton coring have from coring operations on DSN? Any suggestions to improve safety and efficiency? How do Halliburton ensure that the correct equipment (including backup) is delivered in due time?	
	Halliburton answer/comment	BHA selected based on offset wells, experience with formations to be cored. Uncertain if any coring on Rumpetroll well, coring on Shrek might be first operation on DSN. Safety and efficiency suggestions: • Toolbox meeting prior to operations • Lessons learnt from previous wells • Minimize personnel in red zone • Coring decision tree should be used to minimize time used on discussions • Drilling instructions verified upfront and followed (RAP) • Ensure curious un-relevant personnel not standing in the way when core handling Scope and specific equipment is decided with customer, then equipment is allocated and scheduled in HAL's internal system Modem/BSA including amount of back-up equipment agreed upfront with Operators. Call out thru logistic responsible in combination with WELS with dates on delivery for the dedicated Group load are followed closely by the Coring Service coordinator.	
10.2	Personnel competency	What QA / QC system is present to ensure competency of personnel?	
	Halliburton answer/comment	Haliburton are using “The Hub” which are a learning and competency central for all Halliburton employees.	
10.3	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	
	Halliburton answer/comment	New rig, unexperienced rig personnel when it comes to coring operation and the understanding of the sequences.	
12.0	**PGNiG/WE verification of Halliburton Bit services.**		

12.1	Planning vs operational requirements.	How do Halliburton ensure that the most suitable bits for the different sections on Shrek are used? What experiences do Halliburton DBS have from operations on DSN? Any suggestions to improve safety and efficiency? How do Halliburton ensure that the correct bits (including correct nozzles, tool kit and backup) are delivered in due time?	
	Halliburton answer/comment	The bit selection is based on offset data and simulation in cooperation with BHA vendor and as agreed with PGNiG (technical meeting), see presentation attached (ppt). HDBS have an updated inventory/delivery excel sheet that they go through in weekly meeting. A bit container with backup bits will be sent out with the spud loadout.	
12.2	AOB	Please present any other concerns or questions you might have to ensure a safe and efficient operation.	
	Halliburton answer/comment	None.	

3 Conclusion and follow up actions

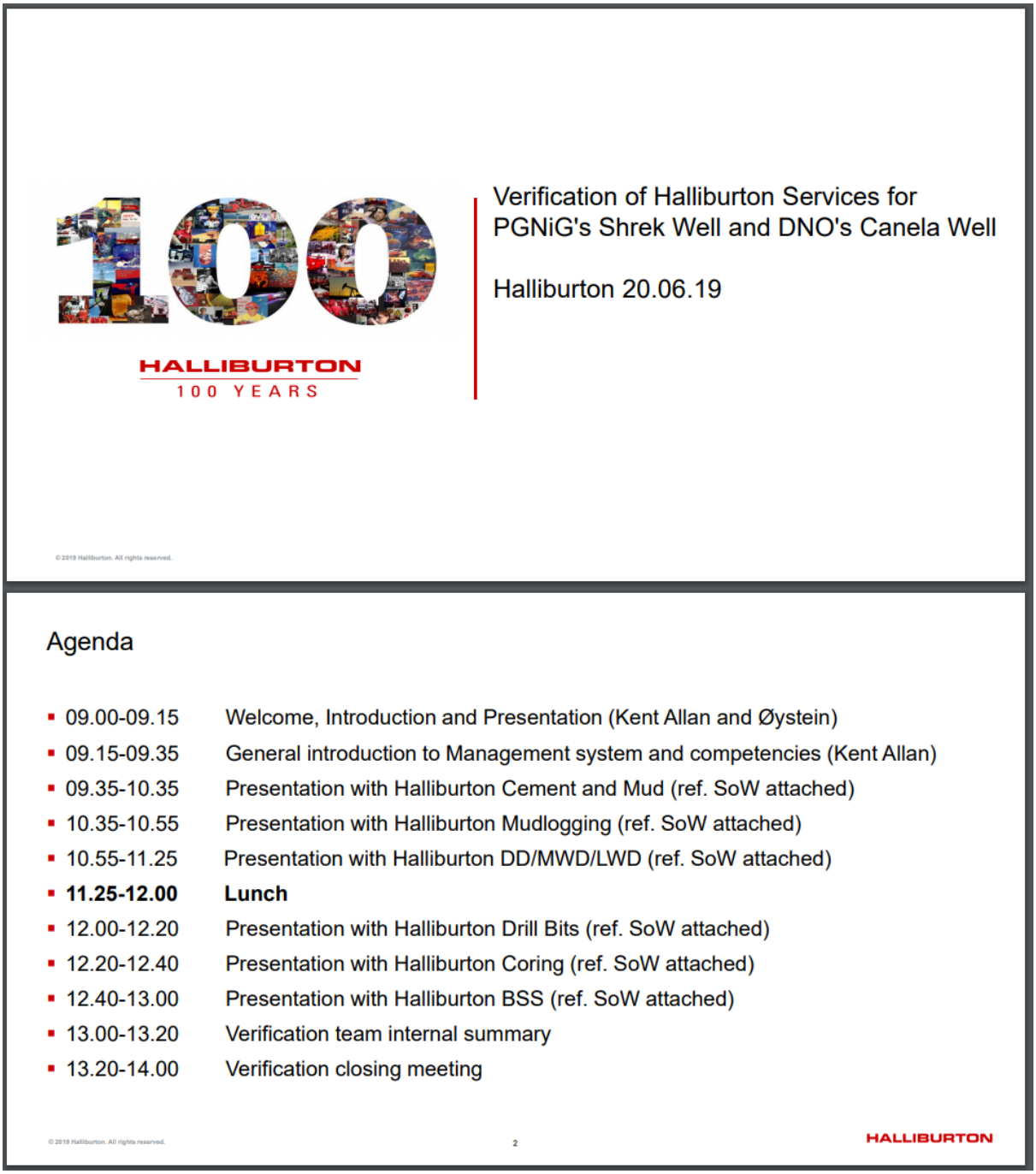
Halliburton management system (HMS) is compliant with regards to the subject of HSEQ reporting and lessons learnt. However, there are no database to support transfer of lessons learned from project to project.

The impression by the auditors is that the Halliburton services are well prepared for the Shrek well. The technical solutions presented for the Shrek well seem robust and Halliburton provided valuable feedback on issues experienced on the Deepsea Nordkapp rig.

The verification revealed that Halliburton have a strong environmental focus on all parts of the organization, and PGNiG/WE encourage Halliburton to continue to keep the high focus up.

For follow up actions, it is expected that Halliburton provide an updated Measurement Program to the environmental auditor (christina@wellexpertise.com).

4 Appendix – Halliburton Presentations



Welcome

- No Drills planned
- In case of an alarm/emergency you will be escorted to nearest muster point (red dots)

HALLIBURTON

Who's Who - Introduction

- Let everyone know who you are, your position and your role within the project.

HALLIBURTON

HALLIBURTON

Safety Moment

HSE – See It, Own It

DID YOU KNOW

SAFETY IS NOT ONLY ABOUT TAKING PRECAUTIONS, IT'S ALSO ABOUT TAKING RESPONSIBILITY.

There's a catch phrase that's being heard more and more these days. "See it. Own it." That phrase is particularly applicable to safety.

If you see an unsafe situation, or even a potentially unsafe situation, don't just walk away. Take responsibility for getting it corrected.

Whether it's in the office, while you're traveling, or at the work site, wherever you see something that you believe is unsafe, or could lead to an adverse incident, speak up. If it's unsafe to actually do something about it yourself, keep others out of the unsafe zone and contact your supervisor.

Think how you'd feel if you did nothing, then heard later that someone was injured.

At Halliburton, solving customer challenges is second only to keeping everyone safe and healthy. You can find more safety tips at **www.halliburton.com/HSE**.

Safety Moment Subject suggested by: Allen McClure, *Halliburton Employee*

HALLIBURTON

HALLIBURTON

How We Work – Halliburton Management System (HMS)

PGNiG/DNO/WE verification Questions

- Halliburton to do a quick summary of Halliburton Management System with focus on HSEQ reporting and implementation of lessons learnt.

- The Halliburton Management System (HMS) outlines how we work. HMS is the integrated set of policies, business practices and procedures that are used by the Company in defining, planning and executing business activities. It enables employees to work safely, consistently and effectively by providing reliable standardized processes such as Design of Service, contingency planning, Management of Change (MOC) and Stop Work Authority.

- Within HMS there are various types and levels of documents. It starts with the Code of Business Conduct (COBC), the overarching policies governing our business. We then have policies and business practices that cover a wider range of activities and are more specific on those topics than the COBC. These also apply globally.

- Standards, process maps and work methods are documents that help us understand how we are to conduct our work to ensure we execute safely, with respect for the environment and with consistent service quality.

HALLIBURTON

PGNiG/DNO/WE verification Questions

- HSEQ reporting and implementation of lessons learnt

- We arrange experience transfer meetings to ensure that lessons learned are systematically applied in future work by evaluating feedback and specific issues.
- The issues we address include:
  - Undesirable Events/Hazardous condition reports
  - Correction, Prevention and Improvements (OneView)
  - Halliburton's "Stop Work Authority"
  - Best practices
  - End of well reports/End of project experience reports.
- The main vehicle for implementing lessons learned is the Continuous Improvement Tools found in OneView e.g Events, Observations,MOC`s and Audit & Assessments.
- Follow-up and Quality Improvement is an integrated part of the system.
- Halliburton log positive and negative experience from our work using KPI/Field tickets. The results are actively used to update our management system, improving our processes and work methods.

HALLIBURTON

PGNiG/DNO/WE verification Questions

- REACH: Are all Halliburton chemical components of individual products registered?

- REACH registrations are dealt with on a global basis by the Halliburton global REACH team.
- The team has registered substances we need to register as a company, and also has the overview over the substances & products where we are downstream users.

- Are all SDS' in accordance with REACH?

- Yes, our Halliburton chemical SDSs are in accordance with REACH.
- In Norway we use EcoOnline database for all our chemicals in Norway.

HALLIBURTON

PGNiG/DNO/WE verification Questions

- Explain process for ensuring that chemicals and cement on rig meets specification of laboratory tests

- Environment; All offshore chemicals requiring HOCNF has this in place.
- HOCNFs are developed on the basis of the requirements within OSPAR and the Norwegian Activities Regulation, and SKIM HOCNF guideline.
- Technical; Done by PSL

HALLIBURTON

PGNiG/DNO/WE verification Questions

- Measurement program; Please provide updated measurement programs for mud and cement Update frequency?

- Done by PSL and will be answered in audit session

- How do Halliburton secure that all chemicals taken on-board are registered in the rig's system (EcoOnline), in binders in storage and hospital? Please verify.

- Implemented HMS site that list Halliburton Process for Registration of Chemicals. This included customer requirements. Ref "Customer Registration"– New Chemicals" in Halliburton Norway HMS system.
- Work method WM-NO-HAL-ENV-021 "Registration of chemical in customers databases and approval of chemical offshore"
- The PSL are responsible for entering chemicals in our customers' systems, which including rig systems.

HALLIBURTON

PGNiG/DNO/WE verification Questions

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HALLIBURTON

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  - Technical; Done by PSL

HALLIBURTON

PGNiG/DNO/WE verification Questions

- Please summarize ongoing work on development of new chemicals used in Halliburton and replacement strategy of Yellow (Y2) chemicals.

- For specific products – ref substitution plan for 2019. please find
- General info are detailed in process map for the update of the plan ref PM-NO-HAL-ENV-003 Halliburton Substitution Plan for Wellbore Chemicals (Offshore Portfolio)

HALLIBURTON

Competency

The Hub

Employee Development Hub
It is an employee' central access point for resources to take charge of their development today and explore opportunities for the future. In The Hub, an employee will also access Learning Central, Competency Central, Employee Profile, and internal job opportunities.

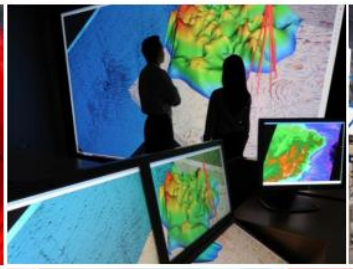
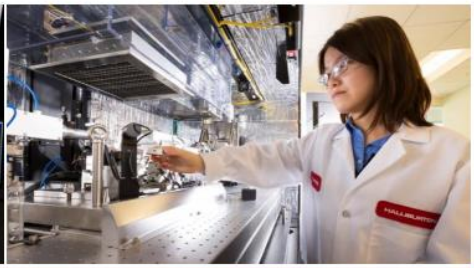
Competency Fundamentals
CompComm

Roles | **Proficiency Levels** | **Training** | **On Job Development** | **Assessment** | **Evidence Standard**

What QA / QC system is present to ensure competency of personnel?

- Assessments are performed by Qualified & Competent Rater
- SAP Manager / Alternate Manager validates the assessments
- Verification and Internal Audit Requirements

HALLIBURTON

Verification of Halliburton Services for PGNiG's Shrek Well and DNO's Canela Well, Cementing

Halliburton 20.06.19

HALLIBURTON

2.2 Halliburton to do a quick summary of:

- **Selection of personnel to support PGNiG/Well Expertise for the Shrek well.**
- **Relevant competence and training.**
- **Assurance that the Coordinators are following the Shrek project through**

Onshore Cement Engineer / Service Coordinator Competency Matrix		
Name	Ingrid Viste	Kjetil Geelmuyden
Education	Bachelors Degree Petroleum	Degree Business Adminstration
Oilfield Experience	21	18
Offshore Experience	Y	Y
Cement Laboratory Experience	Y	Y
Subsea Cementing	Y	Y
Exploration / Appraisal	Y	Y
Field Development	Y	Y
Permanent P & A	Y	Y
Deepwater	Y	Y
HPHT	Y	Y
Horizontal Drilling	Y	Y
Gas Migration	Y	Y
LCM Cemeenting	Y	Y
Light weight cementing	Y	Y
Icem simulation software	Y	N/A
WellCat simulation software	Y	N/A
Casing accessories	Y	Y
Cement Support Tool	Y	Y
Service Tools	Y	Y

- Plan to use the same coordinators for the duration of the well

HALLIBURTON

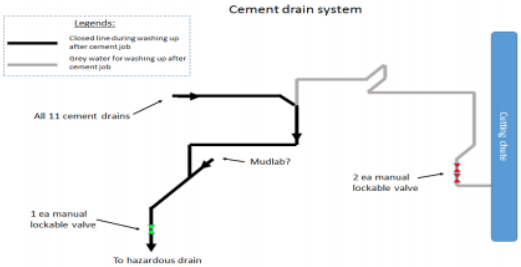
3.2 Please summarize ongoing work on development of new chemicals used in Halliburton and replacement strategy of Yellow (Y2) chemicals.

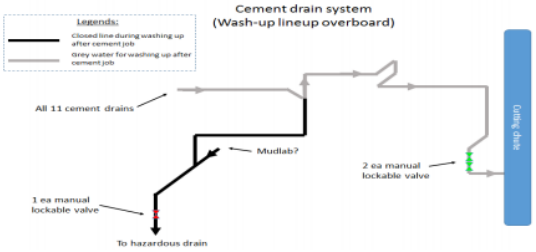
- Continuously reviewing chemical portfolio to replace chemicals with discharge to sea with more environmentally friendly alternatives → Phase out/Replace by a more environmental friendly chemical.
- Halad-300L
  - Fluid loss additive → Halad-500L
    - Alternative for Halad-300L
    - Requires larger concentrations
- SCR-100L
  - Retarding agent → SCR-220L
    - Alternative for SCR-100L

19
HALLIBURTON

3.4 How to avoid spill to sea. Please provide with internal procedure or proposed procedure for operation on Deepsea Nordkapp.

- Drain system during cement jobs
  - Two dump valves in pump room locked with padlock
  - Key stored in control room
  - Requires PTW to get access to key and open
- Halliburton Cementing Work Method
  - Lockout Offshore Halliburton Overboard Discharge Lines (WM-GL-HAL-CMT-RIG-901)
- Proactive
  - Hazard hunt conducted on all Halliburton operated rigs in 2018
  - Ensuring all overboard lines are in accordance with Halliburton policy





20
HALLIBURTON

4.1 Explain main issues on Deepsea Nordkapp today for cementing operations such as chemical storage, working environment, logistics, cement dust from cement operations, etc

Present Halliburton Cement's performance and non-productive time on Deepsea Nordkapp so far. Present reasons and statistics for the rig.

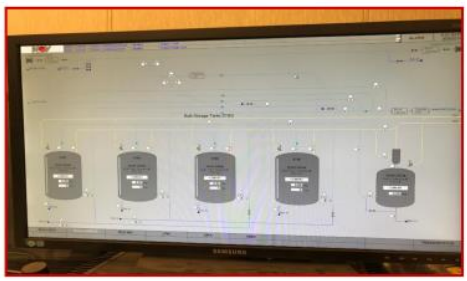
- HCS Advantage™ Remote Electric Cementing System
  - No exposure to noise, dust or pressure
  - Dust extractor installed
  - Six chemical lines
  - Successful mixing test in CCB
  - Five cement jobs performed

- 150 bbl Electrical Batch mixer
  - 2 x 75 bbl tanks
  - Software issue discovered during cement job/mixing test:
    - » Currently being worked on by Halliburton
    - » 1.75 hrs NPT due to unable to achieve target density

HALLIBURTON

4.1 Explain how the cement is transferred from the cement silo to the cement unit throughout a cement job. List if any general problems with rig air, plugged lines or crane operations.

- Cement Bulk System
  - 4 x 80 m^3 Cement silos
  - The Derrick man located in in Cement Control Room
  - Bulk transferred from Silo to Steady Flow Bin (SFB)
    - » Weight indicators on SFB allow steady level
  - Bulk delivery fine tuned during first well
    - » Long distance from silo to cement unit
  - Only two silos can be used during cement job
    - » Two silos do not have remote operated valves
    - » Currently being worked on by Odfjell



HALLIBURTON

4.1 Halliburton to demonstrate benefits and synergy effect of using both cement and mud services from same company

- Synergies and benefits
  - Easy access to required data and samples for testing
  - Optimized fluid properties / compatibilities
  - Sharing chemical stock offshore

HALLIBURTON

4.2 Please share experience on Deepsea Nordkapp with operation of cement head, reliability of the cement head and type used.

- No cement jobs performed yet using cement head on DSN
- A Commander Cement head was sent to the rig for testing
  - Scope
    - » R/B CMT stand in casing FB
    - » R/B CMT stand in DP FB
    - » P/U and M/U CMT head
    - » L/O CMT stand to chute
    - » Simulated hose connection.
    - » Test of Remote control on DF
- No issues performing the tasks in the test scope

HALLIBURTON

4.2 Please share experience on Deepsea Nordkapp with operation of cement head, reliability of the cement head and type used.

P/U CMT head

Check connection height

L/O CMT stand

4.2 Cement stand on Deepsea Nordkapp, are Halliburton delivering cement stand to current operations? The P&A cementing operations require either a cement stand or a cement swivel. Please recommend what should be used for the Shrek operations.

- Only Stand with Side Entry Sub has been used so far on DSN
- We recommend swivel for the P&A plugs to enable rotation during placement

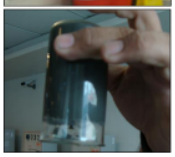
4.2 Please highlight any potential risks for the planned cement job on Shrek with respect to Halliburton equipment and rig and 3rd party interfaces (XO for Dril-Quip running tool, foam cement job for topholes etc).

- Allocation of deck space for foam equipmemt during top hole drilling

4.2 Please comment if backup float equipment and shoetracks from previous wells managed by Well Expertise are usable for Shrek well

- E-mail sent from Kjetil Geelmuyden to Morten Laget & Øystein Prytz 14th of May regarding use excess float equipment for the Shrek well

4.2 Recommend technology for future operations on Deepsea Nordkapp.



FracCem™/ SentinelCem™

Challenge

- Drill depleted reservoirs
- Cure Total Lost Circulation
- Cementing through BHA

Solution

- FracCem: 12-15 ppg cement slurry
- SentinelCem: 10-12 ppg cement slurry
- Highly-thixotropic cement slurries with Low Solids Content and High Yield
- Reduced hydrostatic head treatment
- Easily drillable
- Low temperature sensitivity

Results

- 36 successful FracCem jobs performed in Norway
- Minimizes risks of cost overruns and NPT
- Allows Operator to continue drilling ahead

27
HALLIBURTON

4.2 Please prepare a logistics plan for volumes and chemicals. PGNiG/WE plan on sending a spud vessel from Tananger and will be able to carry premix and chemicals north. Supply base under operations will be in Kristiansund.

Will cement and chemicals from the Skogul operations be backloaded?

		30"	Cont. 9 7/8" Pilot hole	20 x 13 3/8"	20 x 13 3/8"	9 5/8" csg	Plug 1 AB	Surface	KOP	Back Up	Total	TAN	KSU
CFR-8 L	Liter		2000		2500	600	700		700	700	7200	7200	
WellLife 734C	Kg					150					150		150
HR-5 L	Liter		1000	4000	1500	600	700		600	700	9100	7200	
Halad -400L	Liter		2000	1000	4200						7200	7200	
Gascon-469	Liter		2000	5200	6500						13700	13500	
Microsilica	Liter					2500	4500			1600	8600	4300	4300
Halad-350L	Liter					1200	1600			800	3600	4500	
CaCl2	Liter	4000								4000	8000	9000	
FDP-C1316-18	Liter	1500		2700							4200	4500	
NF-6	Liter		200		100	20	40	20	20	20	420	200	
ExpandaCem D NS BLEND	MT					17	41	16	22		96		96
DWFS NS II BLEND	MT	80	50	130	105						365	150	60
EcoSpacer II	Kg		150		150	60	95		100	100	655	500	
Musol	Liter					250	400		300	300	1250		1250
Sem-8	Liter					250	400		300	300	1250		1250
NF 6	Liter		150		100	60	100		60	60	530	310	
6" Wiper ball	ea	2	2	2	2	2	4	2	2	2	20	20	

- No planned excess cement left after Skogul operations

28
HALLIBURTON

4.3 Please verify internal procedure for having cement recipe ready in case shallow gas incident during drilling of pilot hole.

- Cement slurry will be tested and recommendation including slurry recipe will be submitted prior to drilling pilot hole
- Chemicals will be mobilized to rig as a contingency
- Early load out recommended to obtain relevant samples for testing

29
HALLIBURTON

**4.4 Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify. Halliburton to provide PGNiG/WE with CV's for crew. Are the cement crews on Deepsea Nordkapp today trained in using down hole equipment including bridge plugs, storm valves etc?
Explain current requirements for cementers to operate down hole equipment.**

Name	Morten Gjesdal	Arild Ystanes	Olav Paulsen	Kenneth Munro	Brynjar Andresen	Jens Øverli
Position	Svc Leader	Svc Supervisor	Svc Leader	Svc Leader	Svc Supervisor	Svc Operator
Education	Trade Certificate	Trade Certificate	Trade Certificate	Trade Certificate	Trade Certificate	Trade Certificate
Years Oilfield Experience	19	7	31	22	19	7
Nationality	Norwegian	Norwegian	Norwegian	British	Norwegian	Norwegian
Exploration	Y	Y	Y	Y	Y	Y
Field Development	Y	Y	Y	Y	Y	Y
Deepwater	Y	Y	Y	Y	Y	Y
Foam cement Experience	Y	Y	Y	Y	Y	N
Light weight cementing	Y	Y	Y	Y	Y	Y
Plug cementing	Y	Y	Y	Y	Y	Y
Casing accessories	Y	Y	Y	Y	Y	Y
Batch mixer	Y	Y	Y	Y	Y	Y
Cement support tool	Y	Y	Y	Y	Y	Y
Service tools	Y	Y	Y	Y	Y	N

- Plan to use existing crew from Deepsea Nordkapp
- Bi-yearly Tools classroom course
- On the job Tool training
- Downhole Tools Competencies and assessments

30
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4.5 Please present any other concerns or questions you might have to ensure a safe and efficient operation.

- Only able to cement from two silos

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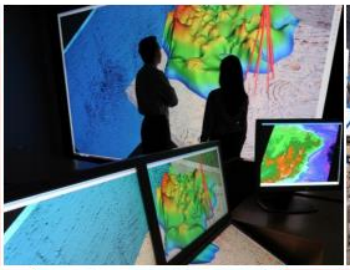


5.0 PGNiG/WE verification of Halliburton Mud services.

Duncan Clinch / Else Karin Vådeland / Renate Dysvik

HALLIBURTON

5.1 Mud operations onboard Deepsea Nordkapp

- Present main issues on Deepsea Nordkapp today for mud operations such as chemical storage, working environment, logistics, fumes in shaker room, etc

- RUG inspection planned 21st June - 25th June by Halliburton HSEQ. As of today improvements are needed in mud lab; New bench in steel, fire proof chemical cabinet needed.
- Further Feedback from the mud engineers is as follows:
  - We've not done much mixing so far and just about to start drilling better understanding after 17.5" and 8.5" sections.
  - Currently communications with town is an issue with town,
    - internet and phones. Aker BP are trying to fix it ASAP.
  - Volume sensors in some tanks and pits are out of calibration
  - Only one hose in loading station common for OBM and WBM transfers from boat
  - Small sackstore, we have 11 containers with LCM on deck
  - Shaker House requires shelves to store the screens, at the moment screens on pallets on the floor.

HALLIBURTON

5.1 Mud operations onboard Deepsea Nordkapp

- Present BaraLogix experience of DSN so far and recommendation.

- No experience yet, so no recommendations on improvements/changes until we've installed. Confirmation that pre-installation work has been performed, verified through Thomas Aguirre. Experience Presentation

- Present Halliburton Mud's performance and non-productive time on Deepsea Nordkapp so far. Present reasons and statistics for the rig.

- Zero NPT
- No wells drilled yet. Spud approx. 19th June.

HALLIBURTON

5.2 Shrek Specific concerns

- There is a risk for losses during drilling of the Shrek well, especially for the 12 ¼" section (Lower Naust Channel Complex).

- **Halliburtons rquirements for loss**
- From the point of view of induced fracturing this appears to be relatively low risk from the simulations overleaf. However running and cementing 9-5/8 inch casing strings on Skarv has historically been suprisingly patchy given the apparently wide window.
- Halliburton's last well near this area, Kvitungen Tumler, experienced 10 m3 losses while circulating during the 9-5/8 inch cement job. Stratigraphically deeper though. Equivalent section was a 16 inch section – cemented ok with no losses observed.

35
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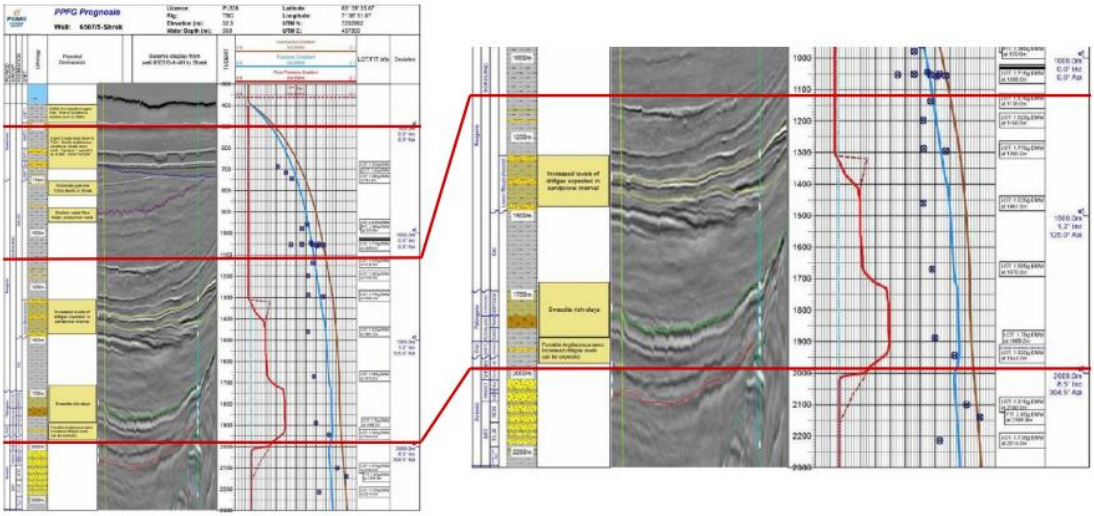
12.25 inch Window



36
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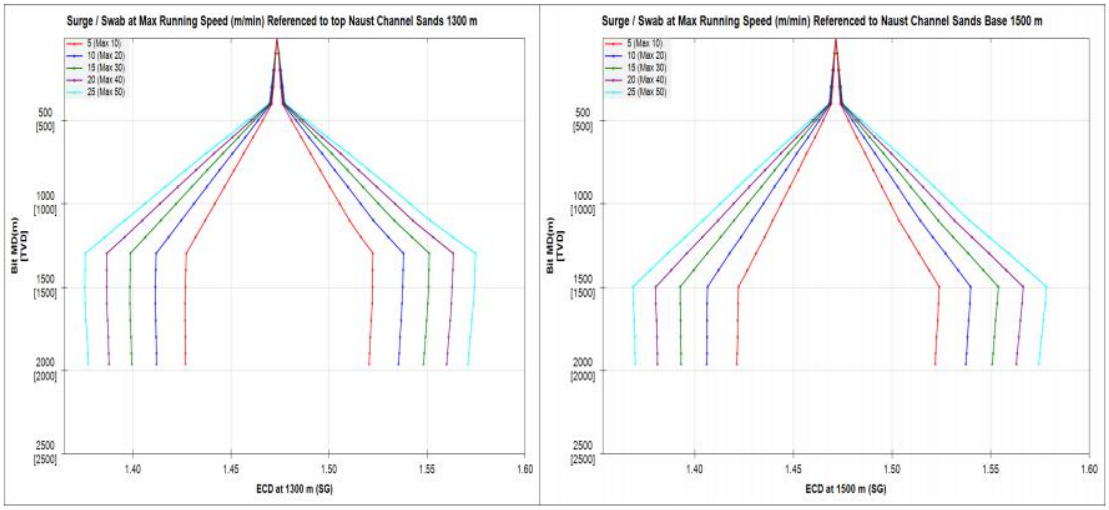
Surge & Swab Running 9-5/8 inch Casing – 1.45 SG INNOVERT NS (Static)



37
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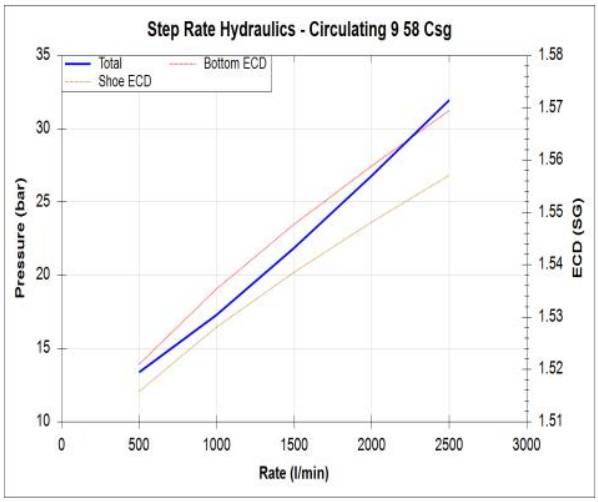
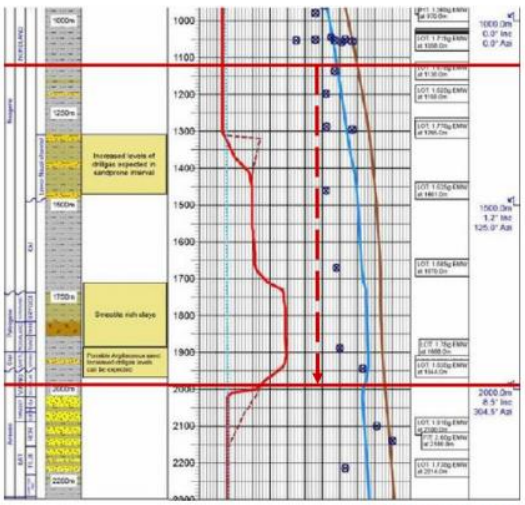
Circulating Casing prior to cement job





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HALLIBURTON

5.2 Shrek Specific concerns

- There is also a risk for swelling clays in 17 ½" resulting in that the mud system must be swapped out. What is the Halliburton proposed requirement for offshore and onshore backup volumes?
  - **This section is programmed to be drilled with an RMR - discuss**
- How is the drilling fluid mixed in Kristiansund controlled prior to be loaded onto PSV to ensure that it meets required drilling fluid specifications?
  - **All mud is checked prior to sending offshore** (both in KSU and in Tananger lab). Mud checks saved and referenced to in Design of Service.

HALLIBURTON

5.3 QA/QC

- Verify how mud programs and ECD calculations are QC'ed internally, especially for cold mud (17 ½" surface section on Shrek will be drilled with MRR and weighted mud).

Mud programs and simulations are peer reviewed according to internal procedures in Halliburton. All has to be aproved before operation.

RMR / MMR simulations are not well catered for with DFG. Nevertheless there is a lot of experience using this system which needs to be levereged

Key Learnings:

- Use GEM GP 3-5% v/v
- 3 rpm 4-10 lbs/100 ft^2
- Shaker Screens 140 mesh typical
- Beware increase in MBT & Gels
- High ROPs > 30 often observed Gumbo
- Welesley used high KCl

HALLIBURTON

5.3 QA/QC

- How can volume of slop be minimized?

Slops:

1. Avoid using exsessive amounts of water
2. Spot slops downhole under cmt plugs (P&A) instead of mud. Both financially and operationally beneficial. End of backloading higher volume of fluid.
3. Slop unit on the DeepSea Nordkapp Good feedback on slop treatment services performed onboard, treating 673 m3 in 11 days. AkerBP happy with performance.

HALLIBURTON

5.3 QA/QC

- How is used mud finger printed, 3rd party? How can Halliburton assure used mud is suitable for Shrek?

Finger-printing the mud:

- This has been performed by other customers in recent times to evaluate whether the amount of reservoir fluids contained within the drilling fluid are important. Further information on this procedure will need to be obtained.

- Less that 20% water content in the mud is requested in 8 ½" section to improve coring analysis. Halliburton to comment if this water level is feasible wrt mud performance.

Water % in Yellow INNOVERT NS:

Halliburton would appreciate further information on what is driving this requirement. Traditional lab testing would typically indicate slightly compromised Sag Stability though for a vertical well this is likely to be less important.

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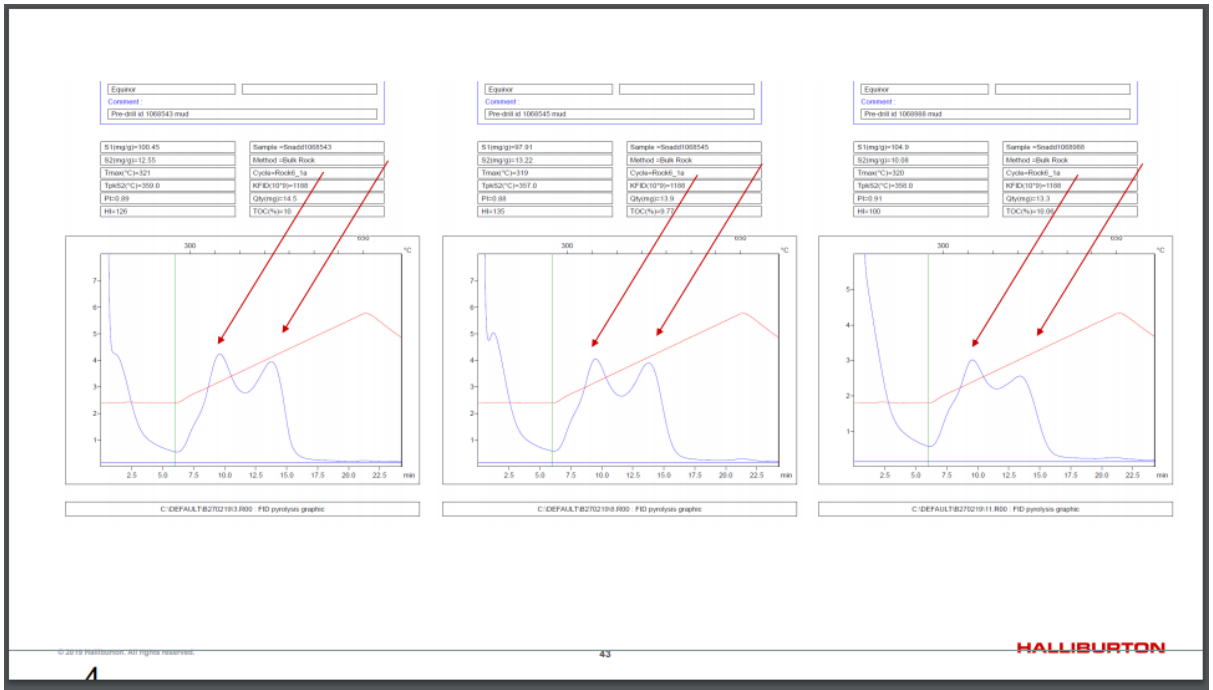
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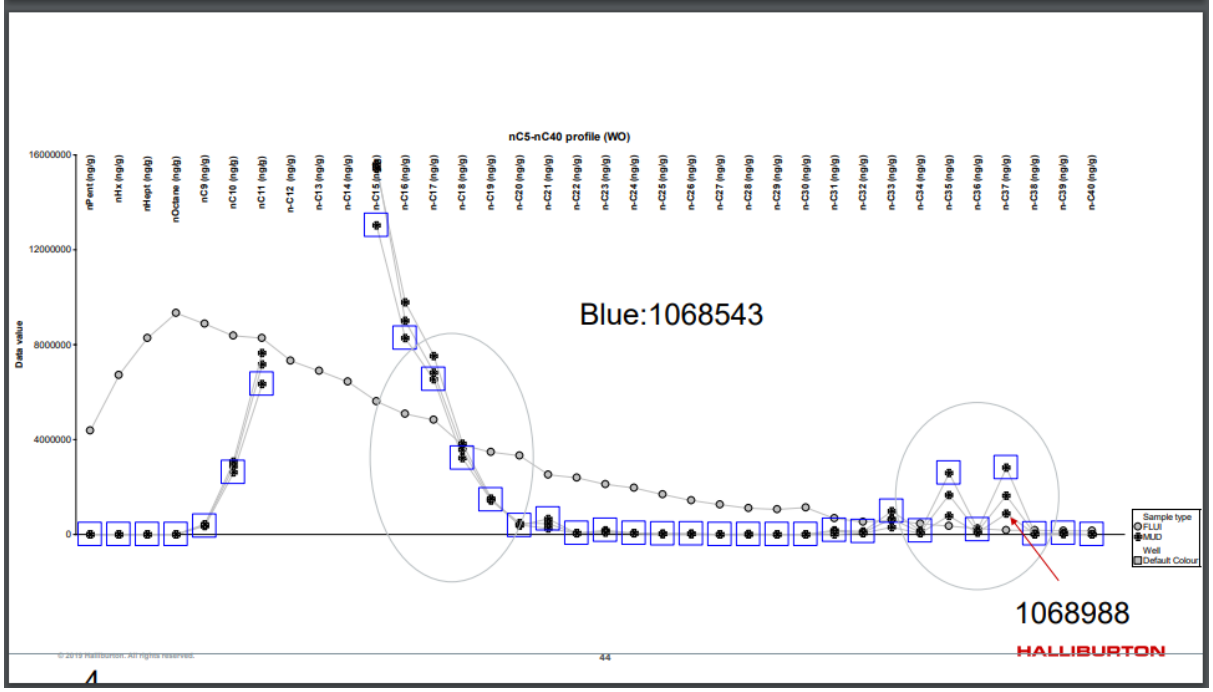
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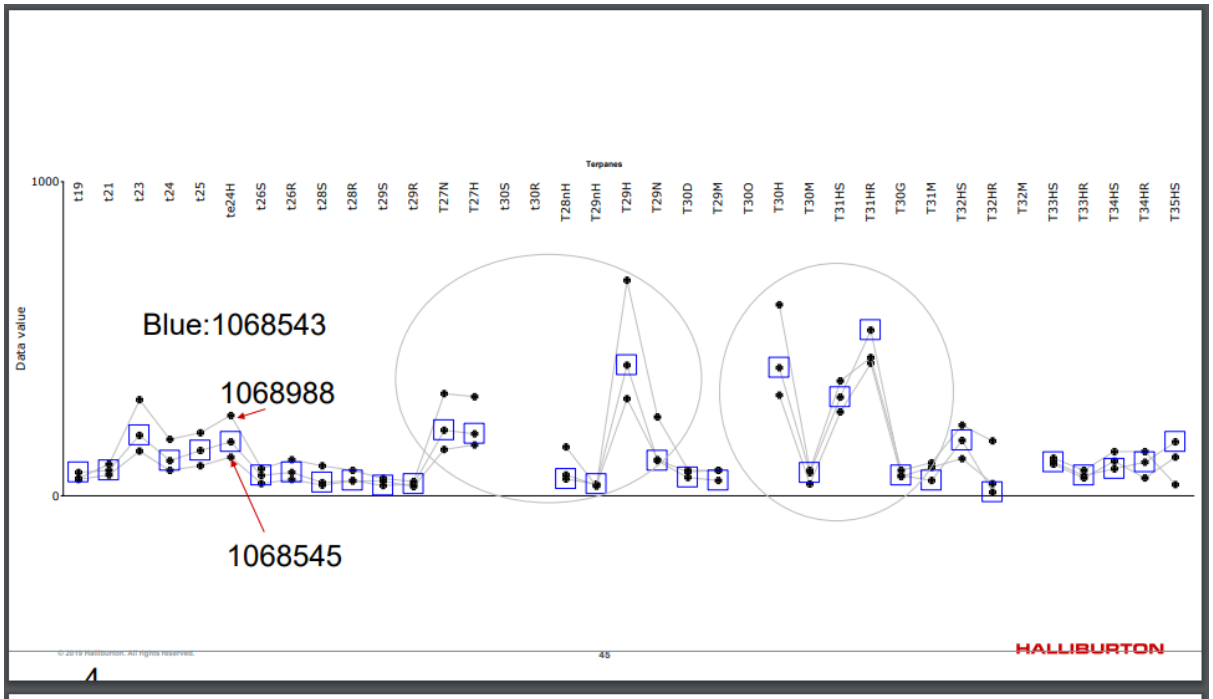
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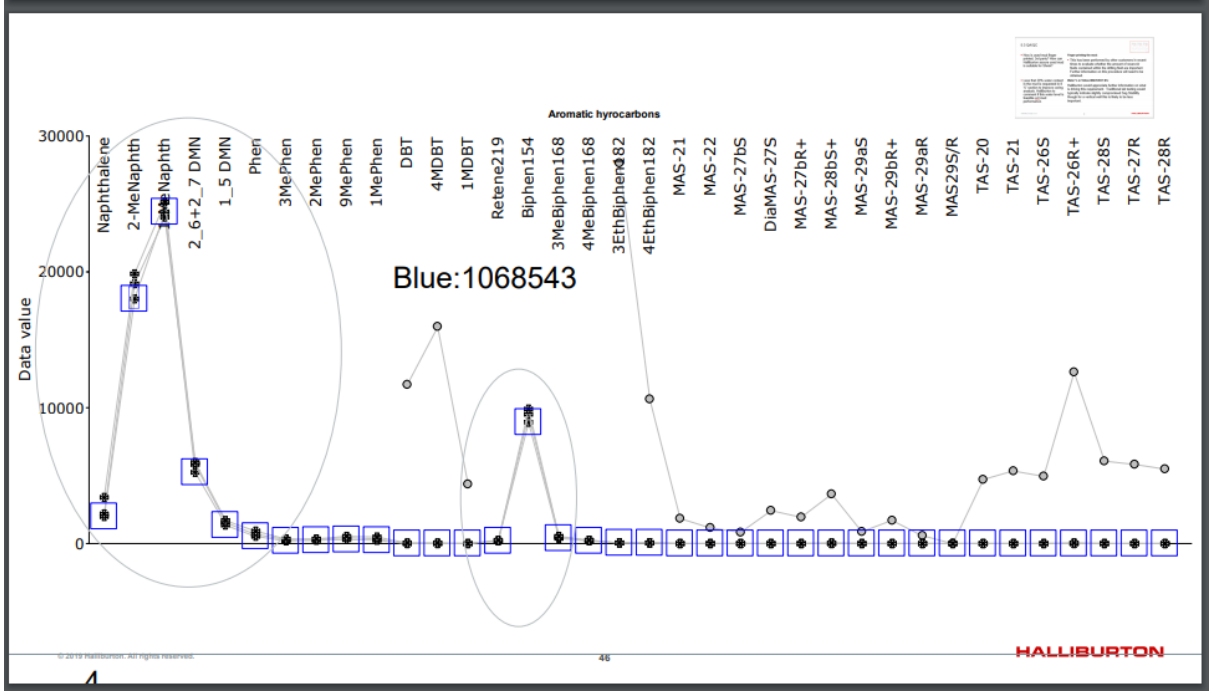
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HALLIBURTON

5.4 Personnel competency

- Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify.
  - Scarabeo 8 crew will be transferred to DSN.
- Halliburton to provide PGNiG/WE with CV's for crew.
  - CV`s will be delivered for review.

HALLIBURTON

5.5 Test Equipment

- Halliburton to provide with checklist for standard laboratory equipment covered by contract and available on Deepsea Nordkapp. Slop needs to be tested for Flash point. Please verify if this is supplied by Halliburton.
  - Lab Equipment according to contract WE-DP-001
  - Flash point tester will be supplied

Contractor shall supply additional laboratory equipment on the drilling unit for performance of the following tests on drilling fluids:

- Funnel Viscosity
- Mud Density
- Plastic Viscosity
- Yield Point
- Gels
- Methylene Blue Tests
- Sand Content
- API Fluid Loss
- HT/HP Fluid Loss
- Filter Cake
- pH
- Pf and Pm
- Chlorides
- Potassium
- Total Hardness
- High/Low Gravity Solids
- Electrical Stability
- Alkalinity
- OBM Calcium (with Filtration)
- H_2S
- Flash Point Tester
- Pilot Test Mixer and 0.01 Gram Scale

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5.6 ABO

- Please present any other concerns or questions you might have to ensure a safe and efficient operation.

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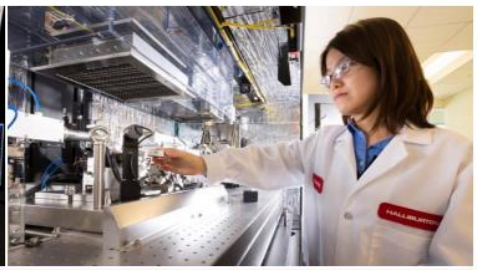

6.0 PGNiG/WE verification of Halliburton Mudlogging services

HALLIBURTON

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6. 1 Are there any issues regarding gas system, gas sensors or gas trap?

▪ Are there any issues regarding gas system, gas sensors or gas trap?	▪ No issues identified at present.
▪ Are the pit sensors working fine? Do they need to be repositioned to avoid false readings?	▪ These are all rig sensors, and were moved to optimize performance at the CCB yardstay.
▪ Who owns the depth encoder? Is there any backup system on the rig to track correct bit depth?	▪ The depth system is provided by the rig.

HALLIBURTON

6. 2 Quality

▪ How is the track record on the data operators to react on a pit drill?	▪ No experience yet.
▪ It is important to be able to communicate correctly to the driller regarding unforeseen variations in the active pits while drilling. Please explain procedure.	▪ Alarms set according to agreed upon Alarm Protocol, the driller to be notified immediately of any deviation, then investigate.

HALLIBURTON

6.3 Personnel competency

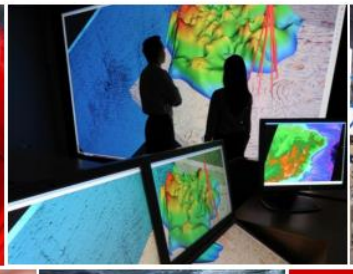
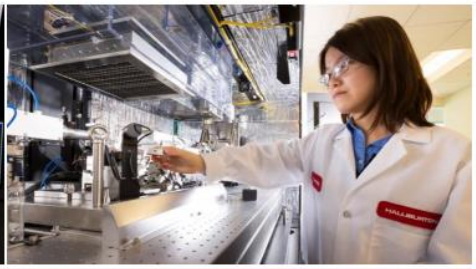
- Is there a consistent crew that knows the rig setup and how to repair gas system, pit sensors and depth tracking system?
  - Yes.
- Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify. cy
  - There are no plans to change the crew.

HALLIBURTON

6.4 AOB

- Please present any other concerns or questions you might have to ensure a safe and efficient operation.
  - Currently no phones in the DCR, experienced some unexpected loss of power in the technical room during maintenance – work is ongoing by Odfjell. Rig signal for Flow Out and Density Out is missing, flagged to Odfjell / NOV. Sperry Flow Out signal goes down slowly sometimes, due to the placement and mud backing up in the flow line

HALLIBURTON

7.0 PGNiG/WE verification of Halliburton DD/MWD/LWD services.

HALLIBURTON

PGNiG/DNO/WE verification Questions

- DD/MWD/LWD operations onboard DSN
  - Are there any issues regarding M/U, racking of BHAs etc. experienced on Deepsea Nordkapp?
- First well in June 2019, current operation and no Lessons learned achieved
- BHAs are made on the main rotary / aux has not enough height

HALLIBURTON

PGNiG/DNO/WE verification Questions

- BHA design
  - All BHA's shall be made up in modules to optimize time spent building BHA's and minimize manual handling on drill floor. The pre made modules should include lifting subs. The subs and lifting sub in the modules shall be M/U with torque according to tool specifications and sign off forms shall be available on rig site.
  - Make up / and break down procedures of all BHA's shall be handed to the drill crew by the directional driller well in advance of the operation included fish drawings of all items in the BHA's supplied by Halliburton.
- The modules are specified during the equipment preparation in the workshop and also shared with the customer, to optimize the handling offshore.
- All the drawings are delivered during the pre-job briefing to the offshore engineers, which are shared with the rig crew prior to start the operation
- All the provided diagrams contain where to break the BHA

HALLIBURTON

PGNiG/DNO/WE verification Questions

- Optimizing connection time
  - Connection procedures including surveys shall be available at the rig site and part of the RAPs (Rig Action Procedures).
  - The procedures should include what to do when surveys are not accepted by the QC (drill ahead / contact DSV).
- HMS
- **PGNiG link**

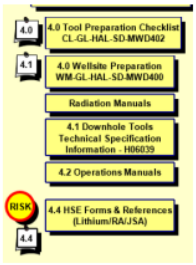
HALLIBURTON

PGNiG/DNO/WE verification Questions

- Radioactive sources
  - What procedures/regulations are Halliburton working by when handling radioactive sources on the rig? Track record, training of personnel, emergency response team.

- HMS has well defined procedures and emergency plans for handling radioactive sources. Under MWD services
- PM-GL-HAL-SD-MWD400

- Halliburton has onshore emergency response team to help to handle incidents 24/7:
  - Crisis Management
  - HSE & SQ - Norway



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PGNiG/DNO/WE verification Questions

- Data quality
  - How to ensure that the correct data type and data rate is transmitted to the surface based on PGNiG geological requests.
  - What is the experience from DSN regarding RT data quality with wired pipe (easy / difficult to decode real time signals) and wired pipe setup in general?

- After the PGNiG delivers the requirements, Halliburton plans the data acquision setup for the MWD tools. During all the planning phase PGNiG will be contacted when necessary
- There is no experience with wired pipe in Deepsea Nordkapp yet. They will run it in the 8.5'' section.

HALLIBURTON

PGNiG/DNO/WE verification Questions

- QA/QC
  - How do Halliburton ensure that the MWD tool flow rates are within PGNiGs request (drilling program)?
  - How do Halliburton ensure that the sensor offset (gamma ray / resistivity) is within PGNiG request (drilling program)?
  - How do Halliburton ensure that the procedures are followed / confirmed OK from when tools are ordered, made up in modules and sent to supply base for shipping out to rig?
  - How is QA/QC of formation evaluation data and directional data performed?

- The flow rates in the planning phase are registered and the MWD TA will request the tools to fit the agreed flow range.
- Halliburton measures the sensor distances in the Control Point #2 and the engineers offshore measure it against CP#2
- Halliburton engineers are trained and follow the internal procedures to perform the job, according to our internal policies and customer's. Onshore team supervises and provide support to the offshore team when necessary
- Data QA/QC is handled by the offshore engineers, then verified by petrophysical group, survey management group and the coordinators that are involved in the operation

HALLIBURTON




8.0 PGNiG/WE verification of Halliburton BSS services.

Odd-Steinar Harkestad

HALLIBURTON

8.1 BSS operations onboard Deepsea Nordkapp

- Pease comment on the availability of skips for the Shrek well.
- How is the current setup on the rig? Have skip and ship been used on DSN or HCB tanks only (backup solution for Shrek)? Is the system working OK, are the cuttings dry when entering tanks, jamming of cutting screws? Is the current setup a limiting factor on ROP?
- Please present track record of slop volume treated vs slop volume transferred back to shore. How can slop treatment be optimized?

- Agreements in place with four venders for delivery of skips.
- Over 6000 skips in the market at the applicable timeperiod.
- Hybrid solution for cuttings handling on DSN:
  - 2 x twin SV400
  - 6 skip bay station
  - 6 HCB tanks (capacity 18 ton)
  - 1 slop unit with OIW analyzer
  - DE-1000 derrick centrifuge & pumps planned installed in July
- Slop unit treated 673 m^3 treated in 14 days
  - 663 m3 discharged to sea
  - Weighted mean oil in water of 6,12 ppm

HALLIBURTON

8.2 QA / QC

- How can we avoid spill to sea?
- How are the skips and HCB tanks certified and inspected prior to use?

- Closed loop system all the way to skip
- Bund wall installed around equipment, drains are closed hazard drains.
- All the skips are built in accordance with Norsok standard.
- The HCB tank have recently underwent a 5 year certification,
- Slop unit and OiW analyzer completed annual EX certification, and Z-015 verifications completed

HALLIBURTON

8.3 Personnel competency

- Halliburton is expected to keep current crew onboard that knows Deepsea Nordkapp setup and operations. PGNiG/WE request that the crew is not changed out for the duration of the well. Please verify.

- We have six supervisors onboard DSN that are on fixed rotation:
  - Jan Atle Aadnessen
  - Geir Arne Larsen
  - Odd Timmie Korsmo
  - Arne Espeland
  - William Bjørklund
  - Morten Wedø
- Supervisors and coordinator to continue with PGNiG project

HALLIBURTON

8.4 AOB

- Please present any other concerns or questions you might have to ensure a safe and efficient operation.

- Insert your answer here and link to HMS.

HALLIBURTON




9.0 DNO/WE verification of Halliburton BSS services.

Per-Magnus (Pelle) Skretting

HALLIBURTON

9.1 BSS operations onboard Island Innovator

- Please comment on the availability of skips for the Canela well.
- How is the current setup on the rig? What system has been used before? Is the system working OK, are the cuttings dry when entering tanks, jamming of cutting screws? Is the current setup a limiting factor on ROP?

- Agreements in place with four venders for delivery of skips.
- Over 6000 skips in the market at the applicable timeperiod.
- We are planning to install 1 x twin SV400 and skip filling solution.
- Rig still in the UK, some details yet to be discussed on setup in Norway

HALLIBURTON

9.2 QA / QC

- How can we avoid spill to sea?
- How are the skips and HCB tanks certified and inspected prior to use?

- Planning for bund walls around our equipment, and need to verify that the drain are hazard drain.
- 1 x SV400 set up with vacuum capabilities in case of spils
- All the skips are built in accordance with Norsok standard.
- Not planning to have HCB on Island Innovator at the moment

HALLIBURTON

9.3 Personnel competency

- Halliburton is expected to supply offshore crew that knows Island Innovator setup and operations. DNO/WE request that the crew is not changed out for the duration of the well. Please verify.

- We are planning to have three Supervisors on a fixed rotation on this project.

HALLIBURTON

9.4 AOB

- Please present any other concerns or questions you might have to ensure a safe and efficient operation.

- None

HALLIBURTON




10.0 PGNiG/WE verification of Halliburton
11.0 DNO/WE verification of Halliburton
Coring Services

Espen Evjenth

Coring Coordinator

HALLIBURTON

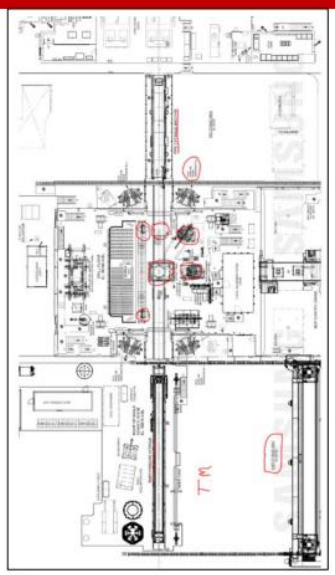
10.1 & Coring operations onboard the DeepSea Nordkapp – 6507/5-9 Shrek

- How are Halliburton ensuring the most suitable coring BHA setup for Shrek – 6507/5-9
- What experiences do Halliburton coring have from coring operations on DSN ?
- Based on offset wells, success factors on the requested formations to be cored
- New rig, we are onboard to plan coring for AkerBP (Rumpetroll) and will use this experience for the upcoming well(s) to optimize the operation for PGNiG
- Any suggestion to improve safety and efficiency
- Toolbox meeting prior to the different sequences during the operation with the rig crew and other relevant personnel
- Minimize personnel in the red-zone at all times (need-to-be basis)
- Premake the Coring BHA and rack it back
- Defined and clear drilling instructions verified upfront and followed
- Make decision trees upfront to avoid discussion and use of valuable rig time for the different scenarios that can occur

HALLIBURTON

Rig Handling on Deep Sea Nordkapp

- The proposed plan as of today will be;
  - The core BHA components & inner tubes will be loaded on pipe storage area and picked up to the pipe catwalk machine and made up in the Aux
  - The Aux has 3 mouseholes ea 14,5 meter and we will load 9 meter corebarrel sections (1 x bottom & 2 x mid-sections). Pick up the top section and make the 36 meter BHA in upward sequences and rack the BHA in the set back
  - The recovery will go from drill-floor and out on the riser handling catwalk and hoisted down to Riser storage area with the Riser gantry crane
  - The core cutting & preservation area will be at the Riser Storage Area below the Riser handling catwalk



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10.1 Coring operations onboard the DeepSea Nordkapp

- How do Halliburton ensure that the correct equipment including backup is delivered in due time

- When the scope and suggested equipment, barrel lengths, core heads, etc are confirmed
  - Equipment is allocated and scheduled in HAL's internal system Modem/BSA including amount of back-up equipment agreed upfront with Operators
  - Call out thru logistic responsible in combination with WELS with dates on delivery for the dedicated Group load are followed closely by the Coring Service coordinator

HALLIBURTON

10.2 Personnel competency
10.3 AOB

- What QA/QC system is present to ensure competency of personnel

- We are using "The Hub" which are a learning and competency central for all Halliburton employees

- Please present any other concerns or questions you might have to ensure a safe and efficient operation

- New rig, unexperienced rig personnel when it comes to coring operation and the understanding of the sequences

- We have a team of coring engineers which are very experienced, with an average of more than 12 years of coring experience.
- They have been working on practically all rigs and platforms in Norway as well as a number of jobs internationally, and their wide experience guarantees the best possible performance of the job.
- We also have a pool of very experienced engineers as a back-up, but always paired up with our local engineers
- Our dedicated coring engineers are our most valuable asset

Name	Age	Years experience as core engineer	Years experience in HDBS	Years offshore experience
Gary Middleton	57	24	24	24
Jan Mela	43	11	11	17
Gert Steine	51	8	8	14
Jan Dyskeland	50	6	6	20

HALLIBURTON

11.1 & Coring operations onboard the Island Innovator – DNO Canela

- How are Halliburton ensuring the most suitable coring BHA setup for Canela
- What experiences do Halliburton coring have from coring operations on Island Innovator?
- Any suggestion to improve safety and efficiency

- Based on offset wells, success factors on the requested formations to be cored
- Island Innovator, we have cored for Lundin on 2 wells in 2015 & 2017
- Toolbox meeting prior to the different sequences during the operation with the rig crew and other relevant personnel
- Use the lesson learned from our previous wells to improve operational and HSE related issues
- Minimize the needed personnel in the red-zone at all times
- Defined and clear drilling instructions verified upfront and followed
- Make decision trees upfront to avoid discussion and use of valuable rig time for the different scenarios that can occur

HALLIBURTON

11.2 Personnel competency
11.3 AOB

- What QA/QC system is present to ensure competency of personnel
- Please present any other concerns or questions you might have to ensure a safe and efficient operation

- We are using "The Hub" which are a learning and competency central for all Halliburton employees
- Our concern is the stability and movement/heave on the rig as the coring operation are weather dependent to be successful
- Rig personnel with experience from coring operation
  - We have a team of coring engineers which are very experienced, with an average of more than 12 years of coring experience.
  - They have been working on practically all rigs and platforms in Norway as well as a number of jobs internationally, and their wide experience guarantees the best possible performance of the job.
  - We also have a pool of very experienced engineers as a back-up, but always paired up with our local engineers
  - Our dedicated coring engineers are our most valuable asset

Name	Age	Years experience as core engineer	Years experience in HDBS	Years offshore experience
Gary Middleton	57	24	24	24
Jan Mala	43	11	11	17
Gert Steine	51	8	8	14
Jan Dyskeland	50	6	6	20

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12.0 Verification of Halliburton Bit service

Prepared by: Chero Nuri

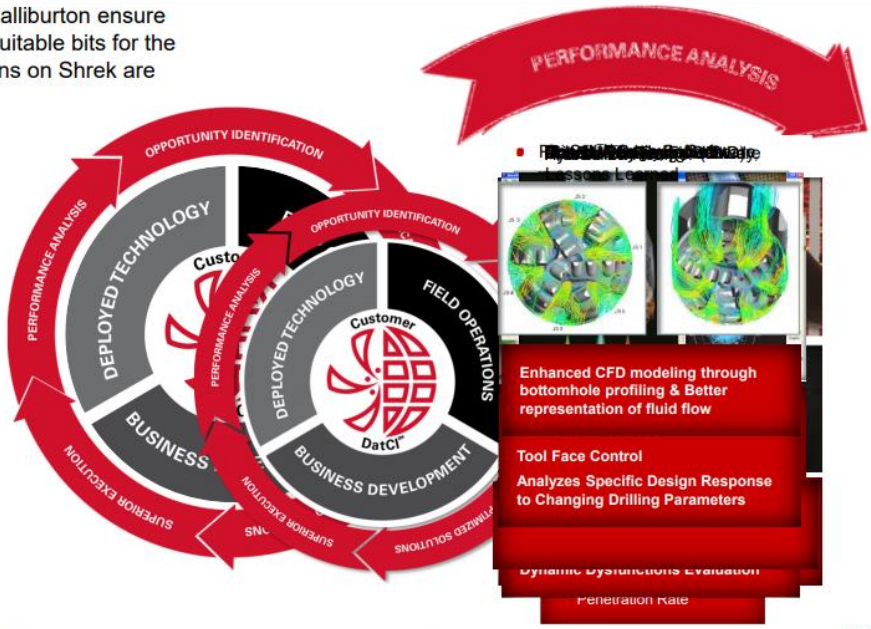
Technical Representative, Halliburton DBS

Mobil + 47 91 58 58 44

June.2019

HALLIBURTON

12.1 How do Halliburton ensure that the most suitable bits for the different sections on Shrek are used?



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Bit Scheduling - How do Halliburton ensure that the correct bits (including correct nozzles, tool kit and backup) are delivered in due time?

RC INVENTORY

Size	Name	Cutter Type	Runs	Material	Equipment	Status	Location	Juni 20	21	22	23	24	25	26	Juli 27	28	29	30	31
12 1/4"	2 1/4" QHK1GC 11	117S	2	615374	11894104	Rental	Offshore	41	41	41	41	41	41	41					
12 1/4"	/4" EQHC1GRC 11	117W	1	631368	11882263	Rental	Offshore done		19	19	19	19							
12 1/4"	/4" EQHC1GRC 11	117W	1	631368	11961686	Rental	In Workshop						23	23	23	23	23	23	
12 1/4"	/4" EQHC1GRC 11	117W	2	795298	12255634	Rental	Offshore	69	69	69	69	69	69						
12 1/4"	/4" EQHC1GRC 11	117W	3	795298	12418774	Rental	Offshore	30	30	30	30	30	30	73P	73P	73P			
12 1/4"	/4" EQHC1GRC 11	117W	1	795298	12429623	Rental	Offshore		33	33	33	33	33						
12 1/4"	/4" EQHC1GRC 11	117W	5	795298	12461978	Rental	Offshore	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44
12 1/4"	/4" EQHC1GRC 11	117W	2	795298	12514080	Rental	Offshore done			58	58	58	58						
12 1/4"	/4" EQHC1GRC 11	117W	2	795298	12548497	Rental	Offshore			56	56	56	56	56	56	56			
12 1/4"	/4" EQHC1GRC 11	117W	3	795298	12548502	Rental	Offshore	33	33	33	33	33				8	8	8	8
12 1/4"	/4" EQHC1GRC 11	117W	0	795298	12604762	New	Offshore done		19	19	19	19							
12 1/4"	1/4" EQHC1RC 11	117W	0	1005782	13025812	New	Offshore				36P	36P	36P	36P					
12 1/4"	1/4" EQHC1RC 11	117W	1	1005782	13025813	On Hold; Rental	In workshop					55	55	55	55	55	55		
12 1/4"	1/4" SRC1GRC 11	117W	0	1058233	13076206	New	Offshore		31	31	31	31	55	55	55	55			
12 1/4"	2 1/4" SRC1GRC 117	117W	0	1058233	13274073	In Order	MFG												
12 1/4"	2 1/4" SRC1GRC 117	117W	0	1058233	13274074	In Order	MFG												
12 1/4"	1/4" EQH04RC 41	417W	0	687834	12259491	Rental	Offshore done		19	19	19	19							
12 1/4"	/4" EQH12DRC 43	437W	1	658888	11668099	CI	In Workshop												
12 1/4"	/4" EQH12DRC 43	437W	1	658888	12017425	Rental	In workshop						35	35	35	8	8	8	8
12 1/4"	/4" EQH12DRC 43	437W	1	795551	12239580	Rental	Offshore done		19	19	19	19							
12 1/4"	/4" EQH12DRC 43	437W	1	795551	12255635	Rental	Offshore	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44	20/44
12 1/4"	1/4" SR12DRC 43	437W	0	1046393	13030759	New	Offshore			35	35	35	35	35					
12 1/4"	1/4" SR12DRC 43	437W	0	1046393	13123209	New	Offshore						55	55	55	55			
12 1/4"	/4" EBXSD16DSP 4	447W	2	472996	10922952	Rental	In Workshop												
12 1/4"	/4" EQH38D2RC 5	547W	1	671836	12191664	CI	In Workshop												

PDC | RC | RC PARTS | CEREBRO PARTS | WELLS | Sheet2