SHELL PETROLEUM DEVELOPMENT COMPANY OF NIGERIA LIMITED

DIEBU CREEK-002T WATER SHUT OFF, PERFORATION & SCON PROPOSAL (with CO log Acquisition)

Document number:	SPDC-2020-08-00000095	**Prepared by:** **Contributors**	Muzan, Eelah (PT) Ogbunude, Basil (RE) Bassey, Imaobong (PG) Ahunanya, Dike (PP) Briggs, Esther (CWI)
Document Owner:	PTD/C/NCC	**Version:**	1.0
Issue Date:	20 August 2020	**Review Date:**	
Record Type Name:	Proposal	**Record Series Code:**	
Security Classification:	Restricted	**ECCN classification:**	Not Subject to EAR - No US Content

I. TABLE OF AUTHORISATION

REVIEWED BY:

Name	Position
Ajaraogu, Benjamin	Production Technology TA2 UPC/G/UR
Mude, Jonathan	Petrophysics TA2 PTD/C/NCC
Okereke, Onyedikachi	Reservoir Engineering TA2 PTD/C/NCC
Etuk, Ubong	Production Geology TA2 PTD/C/NCP
Oluleye, John	Well Intervention Team Lead, WRFM UPC/G/UR

AGREED BY:

Name	Position	Signature
Mude, Jonathan	Soku and Nun River Node Lead PTD/C/NCC	Jonathan Mude Digitally signed by Jonathan Mude Date: 2020.08.20 19:01:00 +01'00'
Ajaraogu, Benjamin	Production Technology TA2 UPC/G/UR	Benjamin.Ajaraogu Digitally signed by Benjamin.Ajaraogu Date: 2020.08.21 08:14:30 +01'00'
Oluleye, John	Well Intervention Team Lead, WRFM UPC/G/UR	John Oluleye Digitally signed by John Oluleye Date: 2020.08.27 15:21:29 +01'00'

APPROVED BY:

Name	Position	Signature
Gogo, Oforiokuma	Asset Subsurface Lead, Central East Asset	Oforiokuma Gogo Digitally signed by Oforiokuma Gogo Date: 2020.09.09 08:33:25 +01'00'

1. TABLE OF CONTENTS

2. OBJECTIVE

WELL (RESERVOIR)	DBUC002T (E2000N)
TYPE	Rigless Intervention
OBJECTIVE	To restore production from DBUC002T on the E2000N sand by carrying out Water Shut Off, Perforation & sand consolidation. This activity will restore a potential of ca. 650 bopd and develop resource volume of 0.93 MMstb.
PROPOSAL	Water Shut Off, Perforation & Sand Consolidation

3. WELL HISTORY/ PRESENT STATUS

DBUC002T was drilled in October 1971 and initially completed in August 1973 as an SSS oil producer on the E2000N. The upper completion is equipped with a Wireline Retrievable Subsurface Safety Valve (WRSCSSV) and sand consolidation for sand control.

DBUC002T E2000N (10292 - 10298 ftah; 10230 - 102366ftss) (SCON)
The interval came on stream and produced dry to a peak of 5,117 bopd in May 1977 with a GOR of 1246 scf/bbl and THP of 1490 psi.

It was re-entered in April 1982 for gas exclusion repairs where the shallow perforations were squeezed off and new sets of deeper perforations added. Post the intervention, the well came in with a BS&W which rose rapidly to about 60%. The interval was closed in for HBS&W in 1983. In January 1996, TT Cement water shut-off was carried out to isolate the old perforation and the interval was perforated shallower as per current perforations.

In August 2013, the WRSCSSV could not be retrieved during a BHP survey operation. After several attempts, the WRSCSSV was retrieved and the ball valve found to be shattered. It was changed out and the interval produced till 2014 when it went down again. The well was re-opened in 2018 after the WRSCSSV was manually pumped open and sectional repairs done on the flowline.

The well flowed till January 2020 when it quit. It was suspected that this was caused by the WRSCSSV being stuck in closed position. A WRSCSSV change out was done in March 2020 after which the well was opened but unable to flow. An SG survey done in the same operation showed that the well had a high-water column which resulted in its inability to flow. (See Appendix 6). In order to unload the water column in the wellbore, foam and gas sticks were deployed in April 2020 but production was not sustained.

The production parameters from the last well test on bean 28/64" in January 2020 are, liquid rate of 2726 bpd, oil rate of 1253 bopd, Water cut of 54%, GOR of 2255 scf/bbl and FTHP of 1566 psig.

The cumulative production from the interval at January 2020 is 13.90 MMstb.

4. PROPOSED ACTION AND JUSTIFICATION

DBUC002T is one of two completions (DBUC002T and DBUC011T) in the E2000N reservoir. The E2000N reservoir as at 31/12/2019 ARPR, has STOIIP/UR/Np/Reserves of 49.3 /35.2/29.9/5.3 MMstb with 61% of the STOIIP recovered to date. DBUC002T has produced 13.9 MMstb since production began in 1973 with reserves of 0.93 MMstb expected to be recovered after this intervention. The E2000N reservoir is saturated with moderate aquifer support as indicated by the reservoir pressure which has declined by 4%.

DBUC0011T which has perforations 9ft deeper than DBUC002T is currently producing at 559 bopd and 72% BS&W. DBUC002T sample BS&W trend of 54% is indicative of a combination of water coning and natural water encroachment into the well. The NW to SE trending anticlinal structure and the stratigraphic architecture of the reservoir, may allow the flow of both bottom and edge water riding on the intra reservoir shale unit as seen in the cross section (Appendix 10).

Upon replacement of the WRSCSSV and SG survey in March 2020, a CITHP of 54psig was recorded. The BHP (SG) survey carried out showed that the water level in the wellbore is at 1070 ftss, indicating that the wellbore is ca. 90% water loaded (Appendix 6). The shut-in period could have resulted in separation of the oil and gas, leaving a dead (water and oil) column in the wellbore, resulting to liquid loading and kick off issues. Given the current reservoir pressure in the well and water cut, the well parameters indicate that the interval can sustain flow, however, will require kick-off assistance. In April 2020, an attempt to kick off the well using foam and gas sticks to generate in-situ foam and assist in lifting the well to production was not successful as the well could not sustain flow afterwards.

An attic oil scope is also available to be produced by the well, as DBUC002T is the most crestal well on the structure. Production data suggests that the opportunity exists, however no CO log has been taken on this interval to confirm the POWC & POGC. It is therefore proposed to acquire CO log during this activity to mitigate the fluid contact uncertainty. Due to the cement plug in the well, the interval that can be logged during the CO logging activity is limited to 10,320 ftah less the tool sensor offset. Also, considering the possibility of sand build-up at the sump, the decision tree (see Appendix 13) will guide the decision whether to proceed or abort the CO logging operation.

Hence, it is proposed to restore DBUC002T by carrying out Water Shut Off of existing perforations using Backstop/H2Zero, perforate attic oil at 10281 – 10287 ftah (10219 – 10225 ftss) – *(to be optimized from CO log results)* and consolidate the interval using SandTrap 225.

Post successful restoration of the well, it is recommended to produce the well below 50% BS&W as the historical performance has shown its inability to kick-off at BSW > ca. 60%.

5. PROPOSAL SUMMARY

1. Make drift run to top of cement plug at 10320ftah. (confirm tubing and sump is free)
    a. If HUD is encountered, RIH LIB to confirm the nature of the HUD. Contact base if HUD is shallower than 10300ftah for further instructions (Follow Decision Tree in Appendix 13)
2. Acquire C/O log across the E2000N interval and await confirmation to continue planned scope from Office based on the outcome
3. Carry out shut off of the existing perforations (10,292 -10298ftah)
4. Perforate the E2000N interval at 10281 - 10287ftah (10219 – 10225 ftss)
5. Carry out sand consolidation using Sandtrap 225 across the new perforation interval
6. Drift the well and confirm no SCON material in tubing and flow back to surface tank
7. Nitrogen lif Well to production
8. Continue unloading until well comes in unaided. (Acquire samples at intervals and WHP).
    a. If well does not flow, contact CWI and PT for advice.
9. Monitor and record wellhead pressures and rates
10. Open-up well on Bean 20/64" and handover well to Production Operations Team.
    a. Bean up sequence will be advised after well handover.

6. PERFORATION

The proposed perforation depths were selected based on production performance from the producing conduits.

A thin heterolith layer of ca. 6 ft below the proposed perforation is expected to provide localized isolation from the bottom water for the new set of perforation and achieve effective water shut-off. The proposed perforation interval will be further optimized post acquisition of CO log data.

	Existing Perforations		Proposed Perforations	
Reservoir	ftah	ftss	ftah	ftss
E2000N	10292 - 10298	10230 - 10236	10281 – 10287	10219 - 10225

Note:
- The existing perforations on the E2000N will be squeezed off during the STOG activity.
- Perforation is a safety critical operation and must be conducted in line with all required safety precautions during gun arming, running in hole and pulling out of hole.

The proposed intervals will be perforated using a deep penetrating gun, 60 deg. phasing, 6 shots per foot. The well will be Nitrogen lifted post intervention operation.

7. POTENTIAL ESTIMATION

The potential estimation for DBUC002T was carried out using the PROSPER IPM tool. The Well model was calibrated with the last well test data in January 2020. PI model was used to define the inflow performance for calibration of the well performance. Productivity Index post Water shut off and perforation is estimated to be the same since the proposed perforation (6ft) is the same length as existing perforations.

Starting BS&W was based on the historical performance of the well after the cement water shout off activity carried out in this well in 1997. The L/B/H scenarios were built around sensitivity on the BSW.

The expected potential was risked using the OP20 Probability of Success (POS) applied on initial rates based on historical success rate in WRFM STOGG Activities for Water Shut Off (30 – 60%). The lower range of 30% was used as there is insufficient data to support level of success for activities done in the Asset.

The summarized table is shown below:

S/No	Scenario	BSW (%)	PI (bbl/d/psi)	Oil Rate (bopd)	Risked Potential (bopd)	Remarks
1	**Low Case**	55	4.7	1176	350	Based on BS&W at last well test & most recent production
2	**Base Case**	35	4.7	2164	650	Reduction in BS&W – starting BS&W of 35%
3	**High Case**	15	4.7	2994	900	Reduction in BS&W – starting BS&W of 15% based on previous performance post cement water shut off

*potential estimated at bean 28/64"

The inflow and outflow performance plot for the three cases is captured in the plot below in addition to the base case.

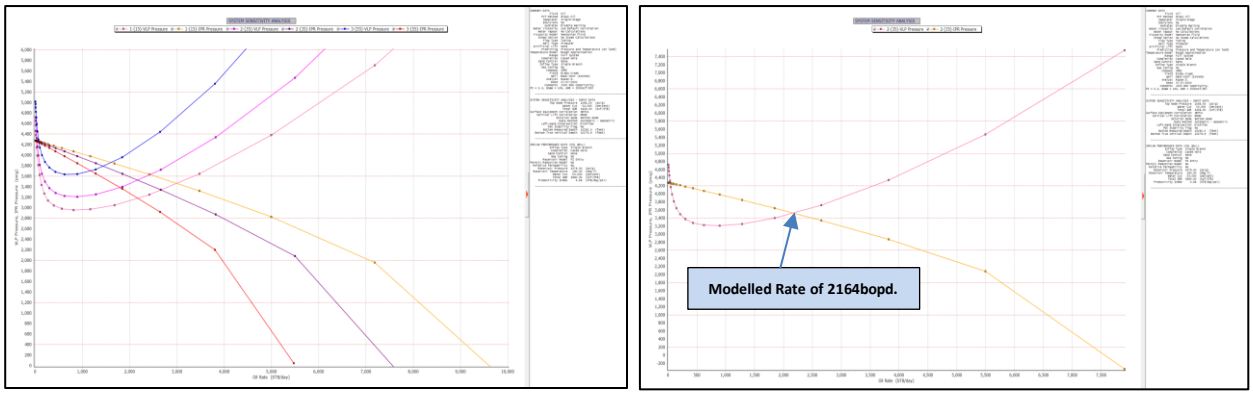


Figure 1: DBUC002T - Scenarios

Therefore, the base case expected potential (Risked) to be unlocked by this opportunity is 650bopd, however the ranges from the technical evaluation can be seen above.

8. RESERVES ESTIMATION

Reserves estimation for DBUC002T:E2000N was done using material balance evaluation methodology. The reservoir PVT data was used to generate a simple PVT model that formed a component of the material balance evaluation. Adequate pressure and production performance history match was achieved by regression of the uncertain reservoir parameters within acceptable range for each parameter. Using the prevailing surface constraints (manifold pressure), a forecast was performed on a well basis for the E2000N reservoir taking into consideration the well schedules, inflow potentials and lift profiles for the wells. This generated a BC reserves of 0.93 MMstb for the DBUC002T opportunity. Below is a summary of the results of the evaluation.

Interval	DBUC002T (E2000N)		
Estimated Reserves (MMstb)	Low	Base	High
	0.43	0.93	1.50

9. WELL & RESERVOIR DATA SHEET

S/N	WELL/SAND:	UNIT	DBUC002T (E2000N)
1	a) Perforated interval	ftah	10292 - 10298
	b) Perforated interval	ftss	10230 - 10236
	c) Proposed Perforation interval	ftah	10281 - 10287
	d) Proposed perforation interval	ftss	10219 - 10225
2	a) Maximum Deviation Angle and Depth	° @ ft	5.25° @ 7620 ftah
	b) Derrick Floor Elevation	ft	50.1 ft above MSL
	c) Vertical Correction to mid- Perforation + DFE	ft	N/A
3	a) Last Production Rate (Jan 2020)	bopd	1253bopd
4	a) Reference Depth for Reservoir Pressures	ftss	10250
	b) Original Reservoir Pressure	psia	4485
	c) Last Measured Reservoir Pressure (March 2020)	psia	4294
	d) Present Point Gradient	psi/ft	0.42
	e) Bubble Point Pressure	psia	4485
	f) Specific Gravity of Oil 60/60	SG	0.82
	g) Oil Viscosity at Reservoir Condition	cP	0.23
	h) Solution Gas-Rsi (initial condition)	scf/stb	1753
	i) Formation Volume Factor (initial condition)	rb/stb	1.751
	j) Static Reservoir Temperature	° F	190
5	a) Other Wells Producing From the same Block	-	DBUC011T
	b) Daily Production from Block (@ June 2020)	bopd	755
	c) Ultimate Recovery (@ 31.12.2019 ARPR)	MMstb	5.3
	d) Cumulative Production from Block (@ June 2020)	MMstb	29.9
	e) Cumulative Production from Well (@ June 2020)	MMstb	13.9
	f) Well DUR (@ June 2020)	MMstb	14.83
	g) Reserve from Well	MMstb	0.93
6	a) Porosity	v/v	0.23
	b) Shale percent	%	0.26
	c) HC Saturation	v/v	0.63
	d) Permeability	mD	2336
	e) Sand Thickness as per PDL	fttv	216
	f) Vertical Permeability/Horizontal Permeability	unitless	NA
	g) Net Oil Sand	fttv	89
	h) Net/Gross Ratio	frac	0.74
	i) Original estimated GOC in Reservoir	ftss	10192
	j) Present estimated PGOC in Reservoir	ftss	NA
	k) Change in GOC from original GOC	fttv	NA
	l) Distance between highest perforation and PGOC	fttv	NA
7	a) Original Estimated OWC in Reservoir	Fts	10313
	b) Present Estimated OWC in Reservoir (From Mbal)	ftss	NA
	c) Change in OWC from Original OWC	ft	NA
	d) Distance Between Lowest Perforation and POWC	ft tvd	NA
8	a) Tubing Size/Weight	in/lbs/ft	3.5" / 9.3
	b) Casing Size/Weight	in/ibs/ft	7" / 32
	c) Shot Per Foot Density (spf)	in	N/A
9	a) Average Hole Size across Completion Interval	in	8.5

10. DATA ACQUISITION PLAN

Carbon Oxygen log will be acquired during the rig less intervention activity to delineate present fluid contact (PGOC and POWC) on the southern part of the E2000N reservoir and further optimize the proposed perforation interval on DBUC002. Gamma Ray/ Casing Collar Locator (GR/ CCL) log will be acquired on wireline for depth correlation.

The logging details are captured in Table 1 below. Logging risk and mitigation plan are covered in Table 2.

Table 1: Detailed Logging Plan

Survey	Formation	Interval (ftah-bdf)	No. of Pass	Original Fluid Type
Drift Run	All	0 – 10320	1	
Sigma Pass	E2000N	9900 – 10320	1	Gas/ Oil / Water
C – O Pass	E2000N	10230 – 10320	4	Gas/ Oil / Water
Interval advised covers water leg to be used for calibration Note: 1. *All depths with respect to PDL and status diagram.* 2. *Correlate and log one pass of the gas view/ sigma mode. For the inelastic mode, a minimum of 4 passes is required.* 3. *Additional pass may be required if Signal to Noise ratio is poor.* 4. *If HUD is encountered, contact operations Petrophysicist or Production Technologist to advise forward plan.*				

Log Required	Logging Interval (ftah)	Remark
GR/ CCL	10000 – 10200	For correlation to put perforating gun on depth

Table 2: Logging Risk and Mitigation Plan

RISKS	POTENTIAL RISK ASSEMENT FOR DATA ACQUISITION (RAM MATRIX)		MITIGATION/MANAGEMENT
	LIKELIHOOD	IMPACT	
Well Control situation during wireline perforation run.	B	4P, 4A, 1E, 2C	Ensure proper well conditioning before commencement of logging. Recommended tool speed for each logging run should be maintained. Appropriate Wire line BOP/ lubricator should be provided as contingency.
Surface gun discharge, gun misfiring and depth correlation mismatch	B	4P, 2A, 1E, 2C	Use radio frequency safe detonators during wireline perforation operations. "Perforate Well on Paper" will be carried out in line with DEP ahead of operations. Run GR/ CCL correlation and interpretation to be carried out to put gun on depth for perforation. Gun firing must have redundancy mechanism.

RISKS	POTENTIAL RISK ASSEMENT FOR DATA ACQUISITION (RAM MATRIX)		MITIGATION/MANAGEMENT
	LIKELIHOOD	IMPACT	
			Inspect all charges to ensure full gun firing downhole.
Personnel exposure to radiation	B	3P, 1A, 4C, 4E	Key logging personnel should wear dosimeters to check exposure to radiation and follow the required guidelines on RA logging tool handling as applicable. The logging tool should be kept and secured with perimeter protection and CAUTION sign before and after operation. The logging tools should be handled by trained and certified personnel ONLY. The lead engineer is responsible for handling the tool during transfer from/ to rack to/ from the logging tool. The logging tool must be 400ft below the surface while RIH and POOH before the neutron generator is switched on and before the continuation of normal operations on the well.
Getting stuck with radioactive tool in hole	C	0P, 3A, 0C, 0E	Ensure the neutron generator is deactivated/ turned off. Ensure availability of appropriate fishing tools at the well site during WL logging. Pre-job safety meeting to hold before operation to intimate everyone of risk involved in deploying radioactive tool.
Inability of the tool to go downhole due to well inclination or borehole conditions (HUD Shallower than Target Zone)	C	0P, 1A, 0C, 0E	Ensure that drift and dummy runs are carried out in all the wells before the execution of the logging program. Maximum deviation is about 5deg, hence minimal restriction is expected
Logging tool unable to go beyond XN Nipple	C	0P, 1A, 0C, 0E	Contractor is required to provide a $1^{11}/_{16}$" tool as well as carry out drift run. Acquire data over revised depths. Risk to be adequately discussed during SWOP/ LWOP to identify mitigation plans for the activity.

11. RECENT WELL TEST DATA

Well Code	Test Date	Bean (/64th)	Gross (bpd)	Net (bopd)	BS&W (%)	FGOR (scf/b)	Sand (pptb)	FTHP (psig)	FLP (psig)	CHP-A (psig)
DBUC002T	09-Oct-2019	24	1635	874	46.5	1926	0.605	1550	210	0
DBUC002T	10-Oct-2019	26	1853	1043	43.7	1833	0.919	1540	220	0
DBUC002T	11-Oct-2019	28	2461	1335	45.7	1899	1.124	1479	290	0
DBUC002T	11-Nov-2019	28	2532	1348	46.7	1842	0.379	1639	290	0
DBUC002T	06-Dec-2019	28	2707	1442	46.7	2080	1.897	1566	319	0
DBUC002T	04-Jan-2020	28	2726	1253	54.0	2255	2.307	1566	313	0

12. COST ESTIMATE

	CO LOG, WSO, PERF, SCON, N2 LIFT	
S/N	Description	Cost $
1	Mobilisation	96,669.60
2	WHM package	44,000.00
3	Slickline package Stdby	101,500.00
4	Slickline package Opr	16,500.00
5	Coiled Tubing Package Stdby	301,376.47
6	Coiled Tubing Package Opr	161,078.06
7	Swamp Logistics	919,915.60
8	Scaffold	3,200.00
9	Sand Trap (1st 10ft interval)	98,850.94
10	CO LOG	55,878.13
10	QA/QC Engineer	11,964.00
11	Back Stop treatment	67,130.10
12	Perforation	50,000.00
13	Chemicals (salts)	83,087.00
14	Liquid Nitrogen	32,000.00
15	Demobilization	64,446.40
16	FTO/Security	137,537.33
17	AGO	30,400.00
18	Crew Flight	72,000.00
19	HSE Officer	20,000.00
20	PBV Installation / Callibration	-
21	OH personnel	22,000.00
22	WHM basic spares	6,000.00
23	Wellhead refubishment	-
	Contingency 20%	479,106.73
	Total	**$2,874,640.36**

13. HSSE/ SPECIAL WELL/LOCATION CONDITION

Condition of wellhead	OK
Last annulus pressure measurement/Date	Annulus A = 0 psig @ 8th May 2020 Annulus B = 0 psig @ 8th May 2020
MAASP/CAOPL	Annulus A = 1647/1240 psig Annulus B = 353/261 psig
Well integrity summary	Well is integral (AC 0)
Any problem during last re-entry	None
Location condition	Well is accessible; albeit with high tide.
Flowline status	Ok
Seasonally flooded	Yes

14. RISKS AND MITIGATION

Risks	Likelihood /Impact (L/M/H)	Effects	Impact on Costs or Rewards	Risk Management Strategy
High AG gas production	H/M	High associated gas production after perforating shallower	No AG facility in Diebu Creek. Will result in Increased flare	Excessive gas production will be managed using bean optimization
High BS&W production	M/M	Water production could be higher than predicted due to contact uncertainty	Low recovery. Reduced Production Rate	Water production will be managed using bean optimization
Well Kick-Off Post treatment	M/M	Post pumping of chemicals, it may be difficult for the well to come in naturally	Increased cost of intervention. Extended execution time	Rock in the well. Nitrogen lift will be used to kick off the well to production
Perforating undesired interval	L/M	Poor depth correlation leading to perforating undesired interval.	Loss of 650bopd production.	Gamma Ray/ Casing Collar Locator (GR/ CCL) log will be acquired on wireline for depth correlation
Poor injectivity prior to SCON deployment	M/M	Poor injectivity can result if the perforation tunnel is not cleaned properly during flowback, leading to inability to deploy SCON	Reduced production rate. Slower oil recovery rate	Acidizing and perforation will improve injectivity Passive sand control method using managed withdrawal & bean optimization
Flowback Management	L/M	Improper planning of flowback operation could lead to spill to the environment	Increased cost of intervention due to spill remediation. Environmental pollution	H2S prediction shows that there is negligible risk of H2S generation from the interval. Sufficient flowback tanks and disposal protocol should be made available in the event of extended lift operations

Risks	Likelihood /Impact (L/M/H)	Justification	Impact on Costs or Rewards	Risk Management Strategy
Loss of well control	M/H	Exposure to pressure from the E2000N reservoir.	Process Safety incident, spill, injury, well intervention cost could be higher depending on the extent of environmental pollution.	The predicted PP and FP for DBUC002T on the E2000N reservoir has been provided in Appendix 12. Use of appropriately rated Pressure Control Equipment
Liquid Nitrogen handling	M/M	Contact with liquid Nitrogen can readily cause asphyxiation and/or cryogenic burns.	Health hazard to staff.	Use of appropriate PPE. Follow approved procedures and guidelines for liquid nitrogen handling.
Loss of CT/ tool in hole	M/M	Possible risk of getting the CT/ tools stuck in hole during the operation.	Increase in intervention cost. Loss of well and asset integrity issues.	Use appropriately sized tools, referencing the status diagram shown. In the event of loss of CT, carry out fishing
Community disturbance	M/M	Good relationship exists between SPDC and the host communities in the Diebu Creek area. However, disruption of well operations may not be completely ruled out.	Higher well intervention cost due to non-productive time (NPT).	Asset team CRCs to liaise in advance with the host communities and resolve any potential conflict.

15. LIST OF APPENDICES

Appendix 1: HSE Critical Activities

HSSE Critical Activities (Rig-less Activities -Wells)

HSE Critical Task			Discipline	Close Out of HSSE Critical Task
Activity		Potential HSE Impact		
4a	Predict H2S presence. **DEP 25.80.10.18**	Loss of life and material integrity.	PT/PG*	The consequence of presence of H2S is loss of life and material integrity. However, available PVT data in Diebu Creek & nearby fields do not indicate H2S presence. The H2S prediction chart in Appendix 11, shows negligible H2S risk in the target Reservoir (E2000N).
5b	Predict pore and fracture pressure in an undeveloped reservoir **DEP 25.80.10.10**	Loss of Well Control and Integrity	PP	Not Applicable. Target reservoir is developed.
5c	Predict pore and fracture pressure in an already developed reservoir **DEP 25.80.10.10**	Loss Well Control and Integrity.	RE	Pore pressure/fracture gradient prediction for developed reservoir has been done and endorsed by technical authority (ref. appendix 12).
7a	Plan logging – Wireline and LWD operations **DEP 25.80.10.15**	Well control, human exposure	PP	GR/CCL will be deployed on wireline for depth correlation to ensure perforation guns are on depth. Logging risks associated with this activity has been captured on Table 2
7b	Plan logging – radioactive sources **DEP 25.80.10.15**	Environmental impact, surface handling risks to people, loss of sources in the hole	PP	Not Applicable.
7c	Plan logging – explosives **DEP 25.80.10.15**	Potential for loss of life. HSSE management of surface and downhole operations	PT	• Personnel should follow the required guidelines on explosive tool handling as applicable. • Explosives should be handled by trained and certified personnel ONLY; Lead engineer is responsible for handling the tool during operations transfer.
7d	Plan logging - Pressurized formation fluid samples. **DEP 25.80.10.15**	surface handling: potential for loss of life.	PP	Not applicable.
7e	Plan logging - TZ and VSP survey operations **DEP 25.80.10.15**	Explosives, Air guns – Potential loss of life.	PP*/GP/WE	Not applicable.

10	Interpret cement bond integrity and casing wear log.	Zonal isolation and potential casing integrity.	PT*/PP	Cement bond log is available. The CBL indicates the bond quality is good above and below the proposed perforation interval.
11	Plan perforation and guns retrieval. **(Integrated as part of DEP 25.80.10.21)**	Hazards to life and facilities (misfired or unfired charges to surface).	PT*/WE	Radio silence will be observed while running in and running out of hole with the gun in addition to other mitigations.
12	Predict sand production. **DEP 25.80.10.19**	Facility / flow-line integrity and loss of containment (LOC)	PT	Historical Sand production is below threshold of 10pptb. However, SCON will be deployed after perforation of proposed interval to forestall future sand production.
13a	Predict produced fluid composition, especially contaminants like CO2, H2S, and mercury and potential formation water composition.	Corrosion and material integrity.	PT	PVT data from Diebu Creek E2000N shows no presence of H2S and insignificant amounts of C02. Hence CO2 and H2S corrosion is highly unlikely.
13b	Predict and manage scaling + reservoir souring impact from water flooding /water injection	Corrosion and material integrity including hazard to life	PT	Not Applicable. Water flooding / water injection is not planned for the target reservoir. However, reservoir souring potential was assessed and captured in Appendix 11.
14	Predict well-head and produced fluid temperature.	Well head growth, surface flowlines limitation and stress integrity.	PT	The predicted / expected wellhead fluid temperature of between 80 - 95degF falls within the range seen in Wells in the nearby fields. Also, the surface casing is cemented in place and no wellhead movement has been seen when this well was producing.
15	Plan (and execute) stimulation. **DEP 25.80.10.21**	Unsafe handling of chemicals (SHOC), equipment failure due to acid corrosion.	PT*/WE	Chemical treatment is planned in the scope of this intervention. Hence, SHOC card procedures are available for these chemicals. Appropriate PPE will be used by personnel on this job. Toolbox talk and job hazard analysis will be conduction. Also, CWI have experience handling these chemicals as per current practice in SPDC operation.
16	Establish safe operating boundaries (MAASP, closed in pressure, erosion and corrosion limits, etc.) for well integrity management.	Loss of well integrity.	PT	MAASP for the well and indeed well integrity boundary parameters are actively managed in e-WIMS. Presently, Diebu Creek 002 has action code 0 (May 2020) and no record of annulus pressure. Preventive maintenance/well integrity assurance activities are routinely carried out.
17a	Top-seal integrity assessment for primary recovery, waterflood, EOR and CO2 storage	Human exposure, environmental and asset damage	PG	The risk of top-seal leakage due to primary recovery is considered medium. Geomechanical screening risk assessment carried out in Diebu Creek does not indicate risk of Top seal integrity issues.

	DEP 25.80.10.22			
17b	Prepare Abandonment Design option and program	Human exposure, environmental and asset damage.	PT	Not applicable.
18	Predict and monitor reservoir compaction and subsidence. DEP 25.80.10.16	Loss of wells, facility/platform integrity.	PP	The risk of compaction and subsidence is estimated to be low for Diebu Creek field.
24	Prepare and maintain data to support emergency response. **DEP 25.80.10.12**	Lack of data or wrong data during emergency response may aggravate the emergency.	PT/PG*	All relevant well data and latest well information required for emergency response have been loaded in the SIRUS CATALOG CDS and ERO Portal in Appendix 16. SIRUS CATALOG, CDS & ERO Portal.
26	Identify Hazards (HAZID) and prepare Hazard Register	Integral part of HSSE Case development. To confirm selected concept/process can be developed into a safe and operable plant.	WE	This intervention is planned on existing well. Hence, well design is not applicable. HSSE risks and mitigation for this Intervention will be built into the execution program

*Accountable Discipline, as per Published DEP

Appendix 2: DBUC002 Well Status Diagram

RE-COMPLETION STATUS OF DIEBU CREEK WELLS — **WELL : DIEBU CREEK-2**

CASING

SIZE	GRADE	WT.	DEPTH	CEMENT	SG
36"	STOVE	PIPE		DRIVEN	
18-5/8"	J 55	87.5	278	600 SXS POZ MIX	1.63
10-3/4"	N-80	51.0	2540	1000 SXS POZ MIX	1.62
"	J 55	40.5	3490	REC. TOP ANN. AT	
"	N-80	51.0	5009	180'w/150 SXS POZ MIX	
7"	N-80	26.0	2546	800 SXS DW	1.9
"	"	23.0	5637	CEMENT	
"	"	26.0	7679	CALCULATED	
"	"	29.0	10185	TOC = 6861	
"	"	32.0	11984		

WELLHEAD

ITEM	TYPE	SIZE (INS)	WP (PSI)
GATE VALVE			
XMAS TREE	SSB	6" x 3-1/8" c/w CLP	5000
ADAPTOR FL.			
TUBING HANGER	DC-ERB	6" x 3-1/2" HCS c/w	CLP
TUBING HEAD	DCB	10" x 6"	5000 x 5000
SPOOL			
CSG. H. HOUSING	WF	10-3/4" x 10"	5000
SEAL BUSHING	'X'	10" x 7"	ENERGISED

TUBING

STRING	SIZE	WT	GRADE	TYPE
STRING	3-1/2	9.3	N80	HCS
STRING	2-3/8	4.7	N80	EU

DEVIATION

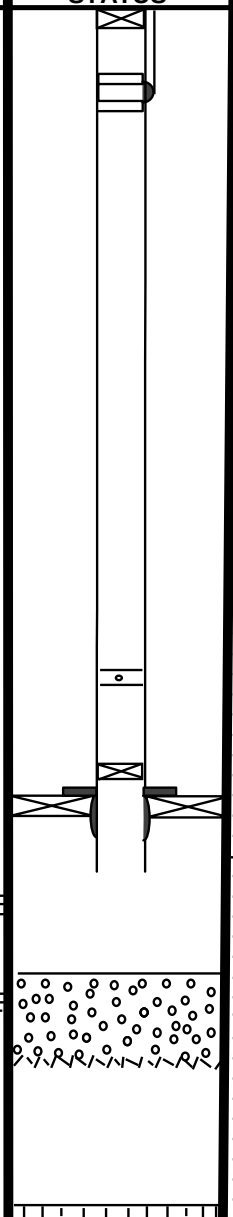
MAX. 5-1/4° AT 7620 FT

DFE 50.1 FT
ORDE-TOP CHH 37.0 FT
ORDE-TOP XMT 32.0 FT

HOLE

22	221
14-3/4	5015
9-5/8	12000

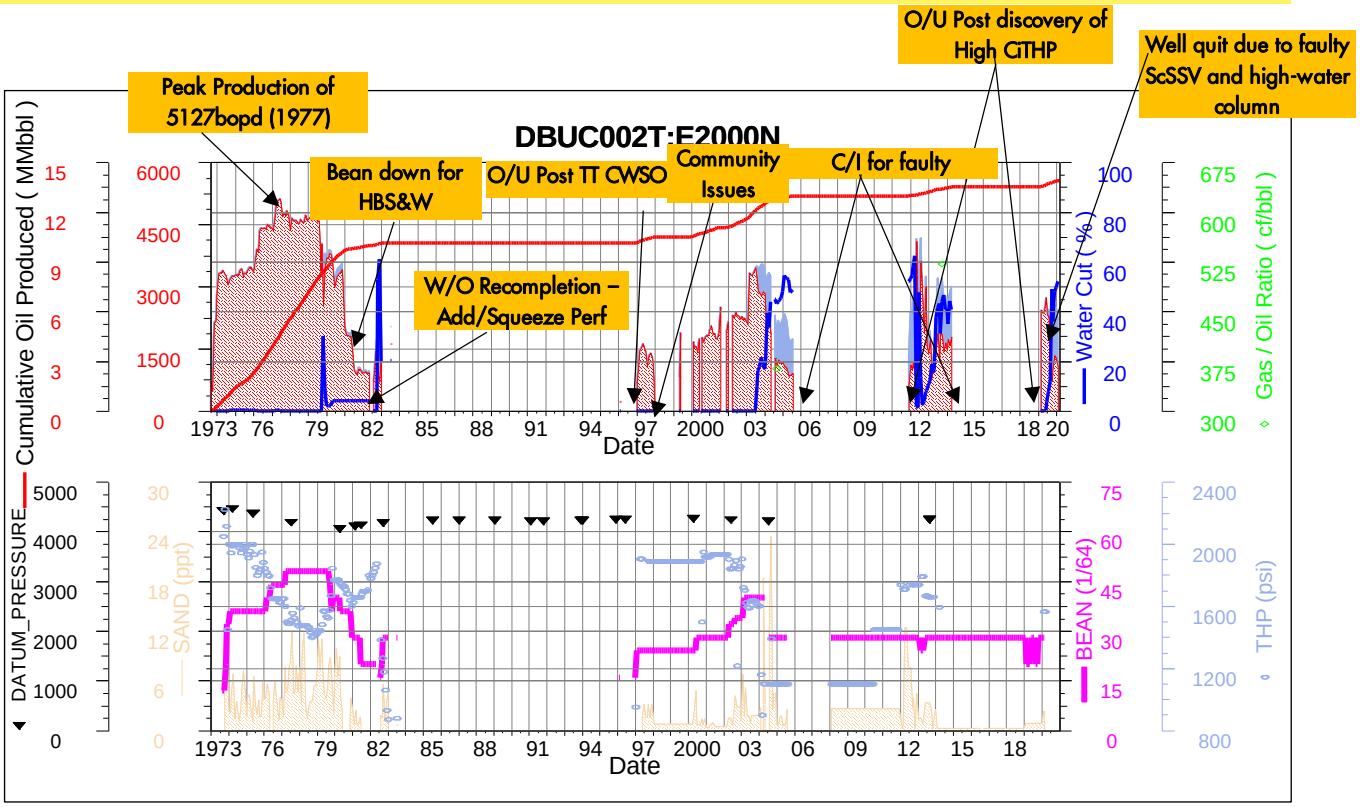
OPEN HOLE PLUGS	ACTIVITY	MAX SG	RESERVOIR	DATE
NONE	DRILLED	1.17	ALL	10/71
-	IN. COMP.	1.05	E2.0	6/73
-	RE-COMP.	1.01	E2.0	4/82
-				
-				
-				



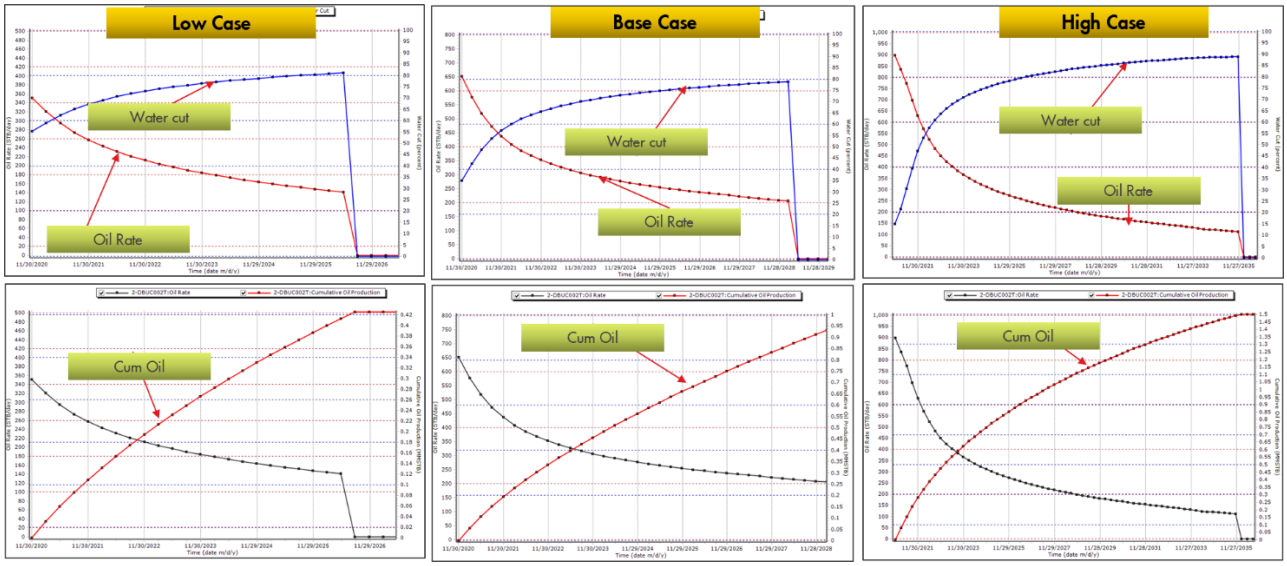
SAND	PERFORATIONS	DEPTH (FT)	STR	DESCRIPTION
			"	X-OVER, 3-1/2 HCS P x p
			"	OTIS ALLOY FLOW COUPLING, 3-1/2 HCS
		102	"	OTIS 'XEL' BALL VALVE NIPPLE, 3-1/2" HCS
		9962	"	OTIS 'XA' SLEEVE, 3-1/2 HCS
		9996	"	X-OVER, 3-1/2 HCSb x 2-3/8 EUp
			"	MOD 'G' LOCATOR SEAL ASSY (81 - 32) + 5 SEALS
		10000		BAKER MOD 'D' PKR (84 - 32) + EXTN.
E2.0		10230		END OF CUT 2-3/8" TUBING
	10292 - 10298 UNTREATED		"	
			"	
		10320		TOP OF CEMENT
E2.0	10327 - 10333 SQUEEZED OFF JAN 1996			
		11592	"	POSSIBLE TOP RESISTANCE
		11881		TOP PLUG

LOGS	TD = 12000 FT	AUTHOR: PBE-WT, SPDC NIGERIA	UPDATED BY: DAVID UNEGBU	DATE: 11/11/98
DLT/GR, FDC, CDM, SL/BHC, CST FTT, CBL/CCL/CNL				

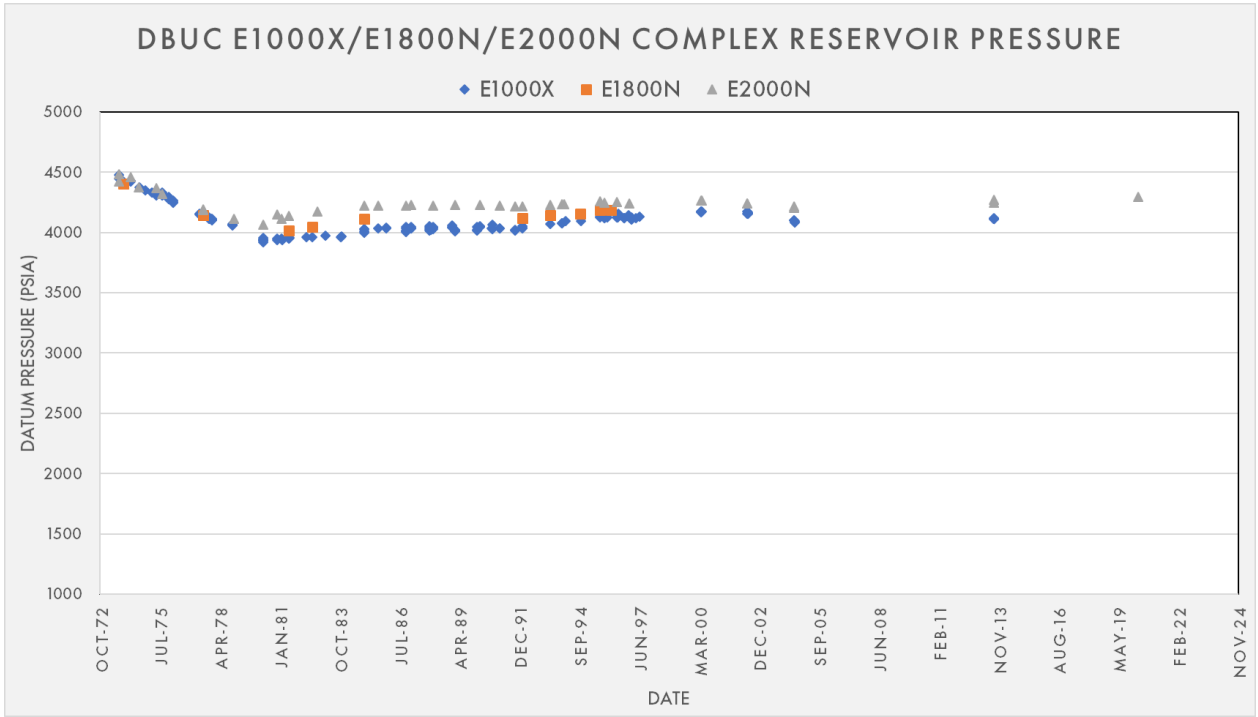
Appendix 3: DBUC002T Production Performance Plot



Appendix 4: DBUC002T Reserves Estimate



Appendix 5: DBUC E1.0X/E1.8N/E2.0N Complex Pressure Trend & SG Interpretation



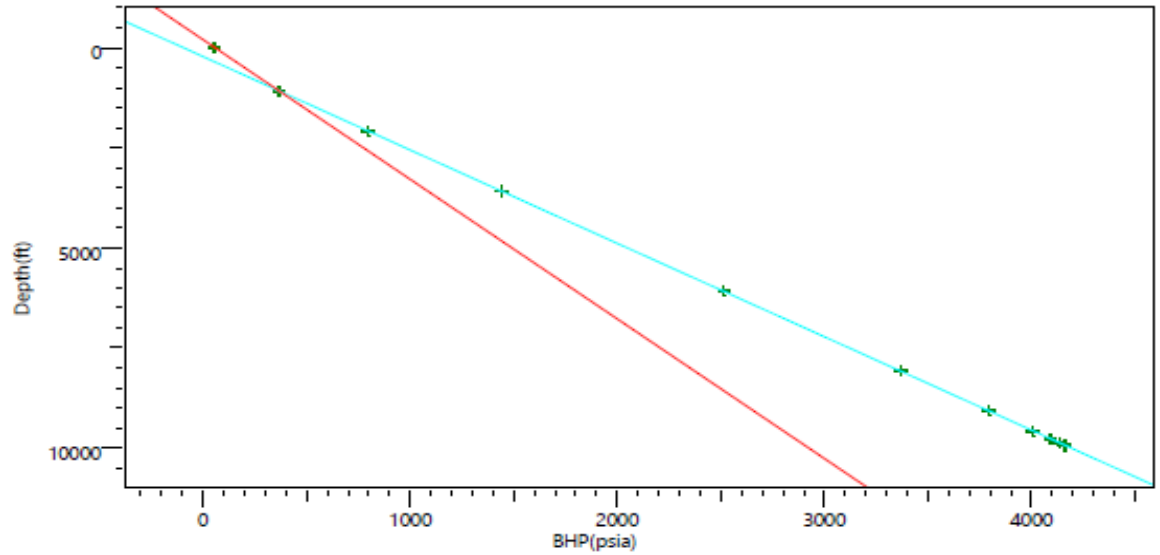
Appendix 6: 2020 SG Result - Tubing Fluid Level Analysis

KAPPA

Gradient Plot (90931-DIEBU... | Untitled1

Company | Field

Well Tested well | Test Name / #



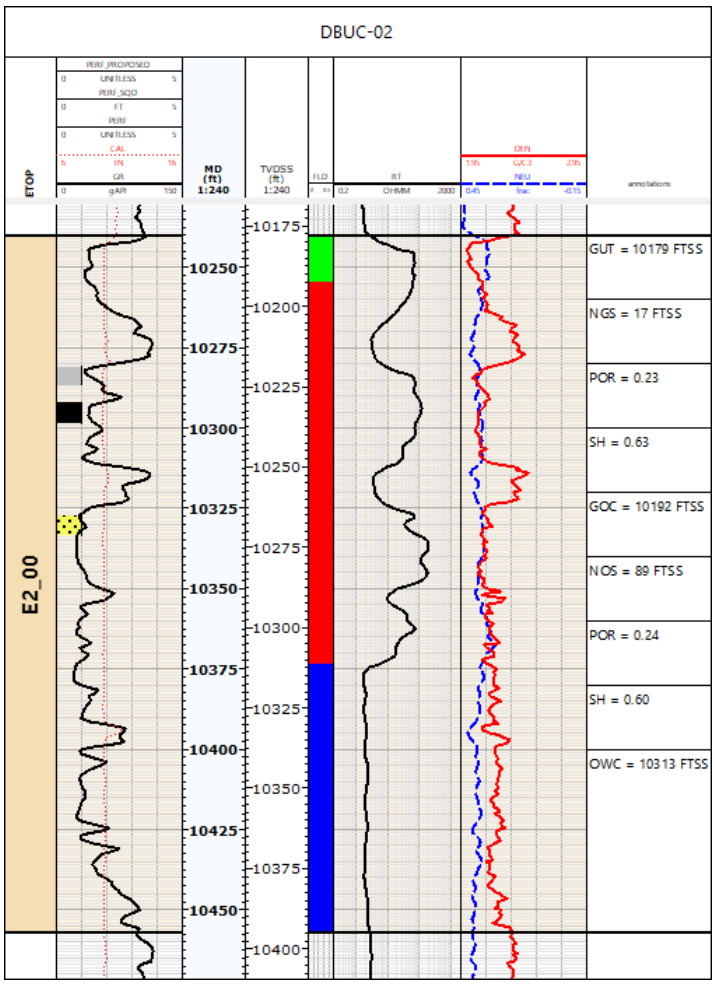
Line 2
Line 3

Time hr	BHP psia	TVD ft	WHP psia
1.79639	4164.57	9939.88	0
2.06444	4155.47	9919.89	0
2.27972	4134.1	9869.94	0
2.46444	4091.57	9770.03	0
2.69222	4006.65	9570.61	0
2.96583	3793.82	9072.49	0
3.295	3368	8076.59	0
3.82417	2512.73	6080.62	0
4.30889	1440.24	3581.51	0
4.66861	796.649	2081.86	0
4.94778	366.223	1081.98	0
5.27139	55.902	-1.58618E-4	0

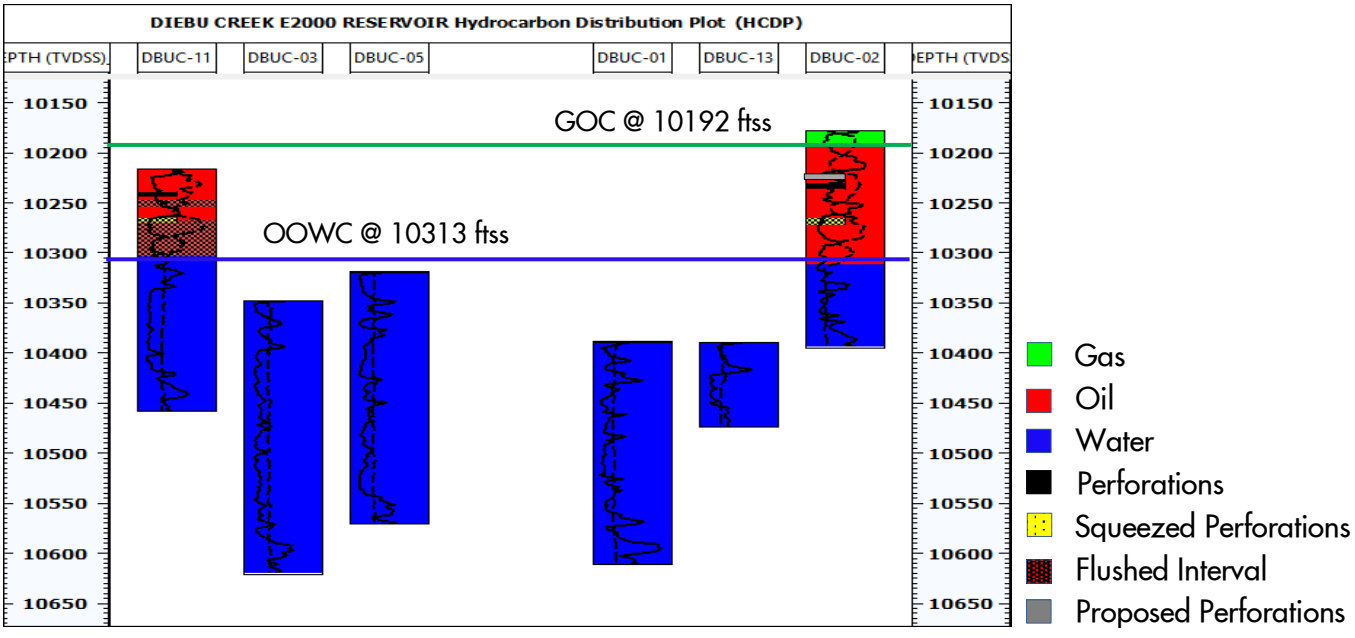
Pressure (Int. Lines 2 & 3) 362.768 psia

Slope (Line2)	0.428581 psia/ft
Intercept (Line2)	-95.7841 psia
Slope (Line3)	0.286809 psia/ft
Intercept (Line3)	55.902 psia
Depth (Int. Lines 2 & 3)	1069.93 ft

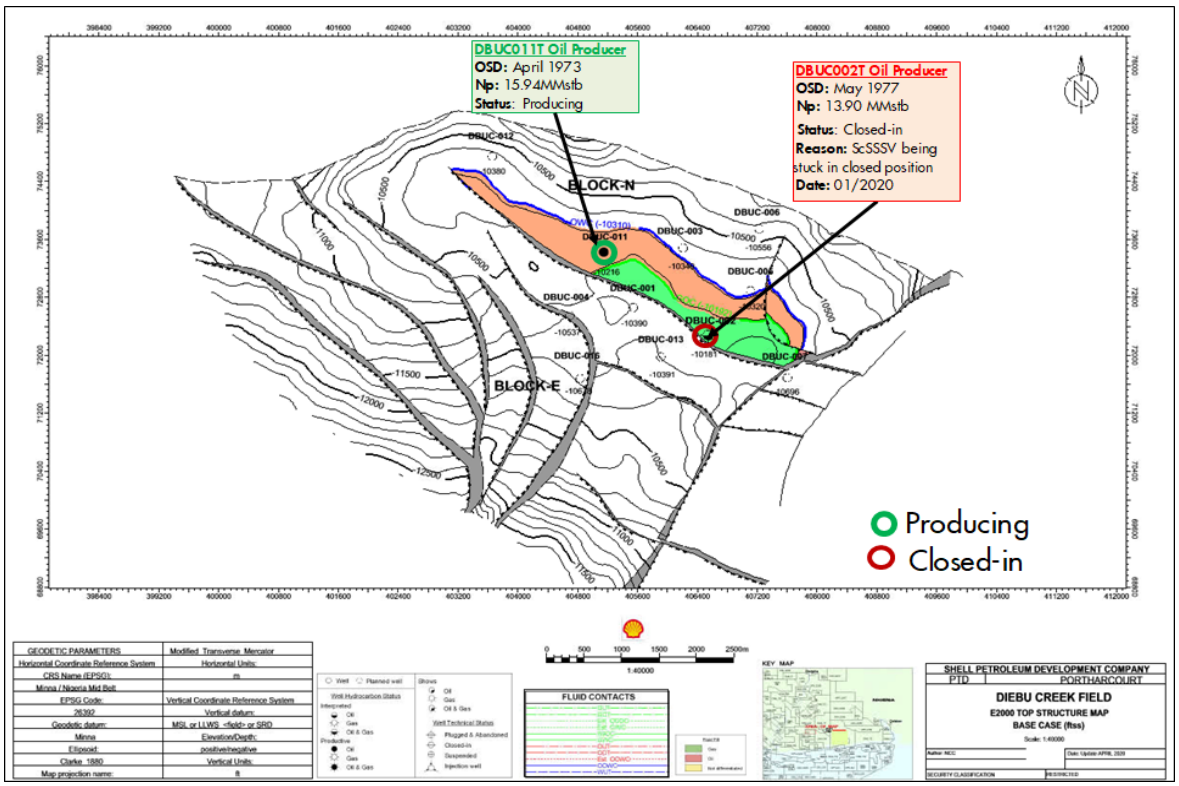
Appendix 7: E2000N Petrophysical Data Log



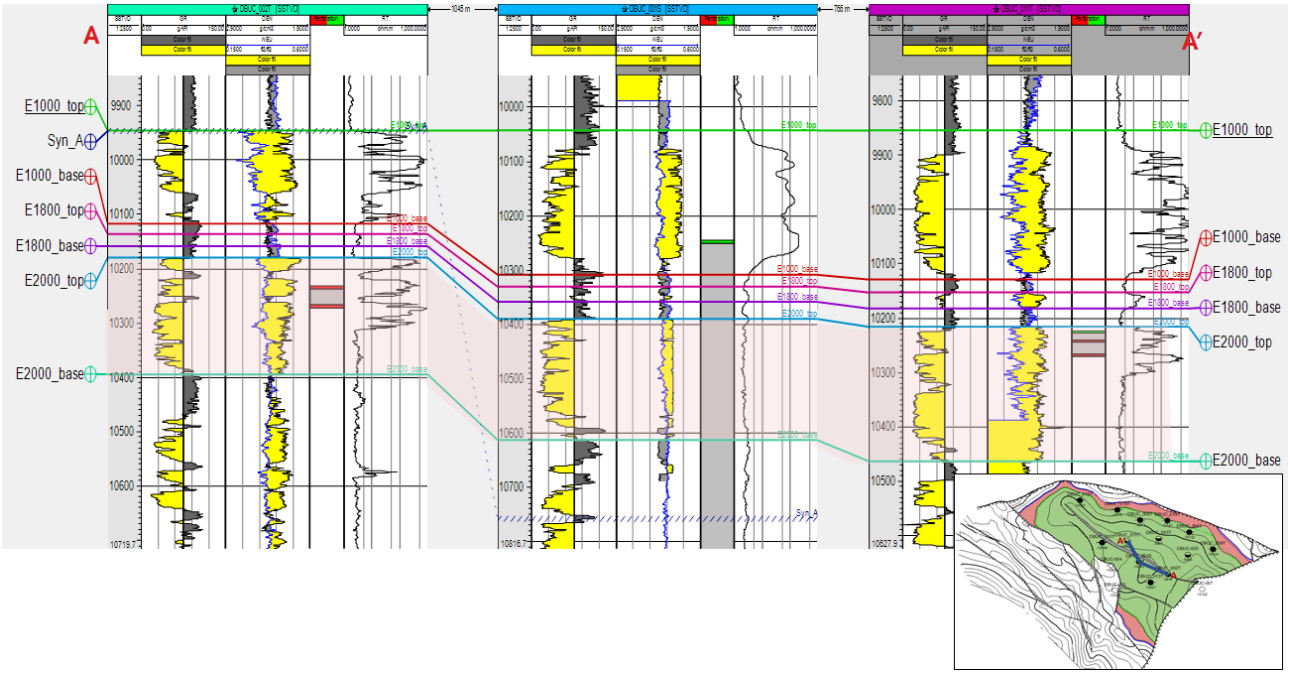
Appendix 8: E2000N Hydrocarbon Distribution Plot



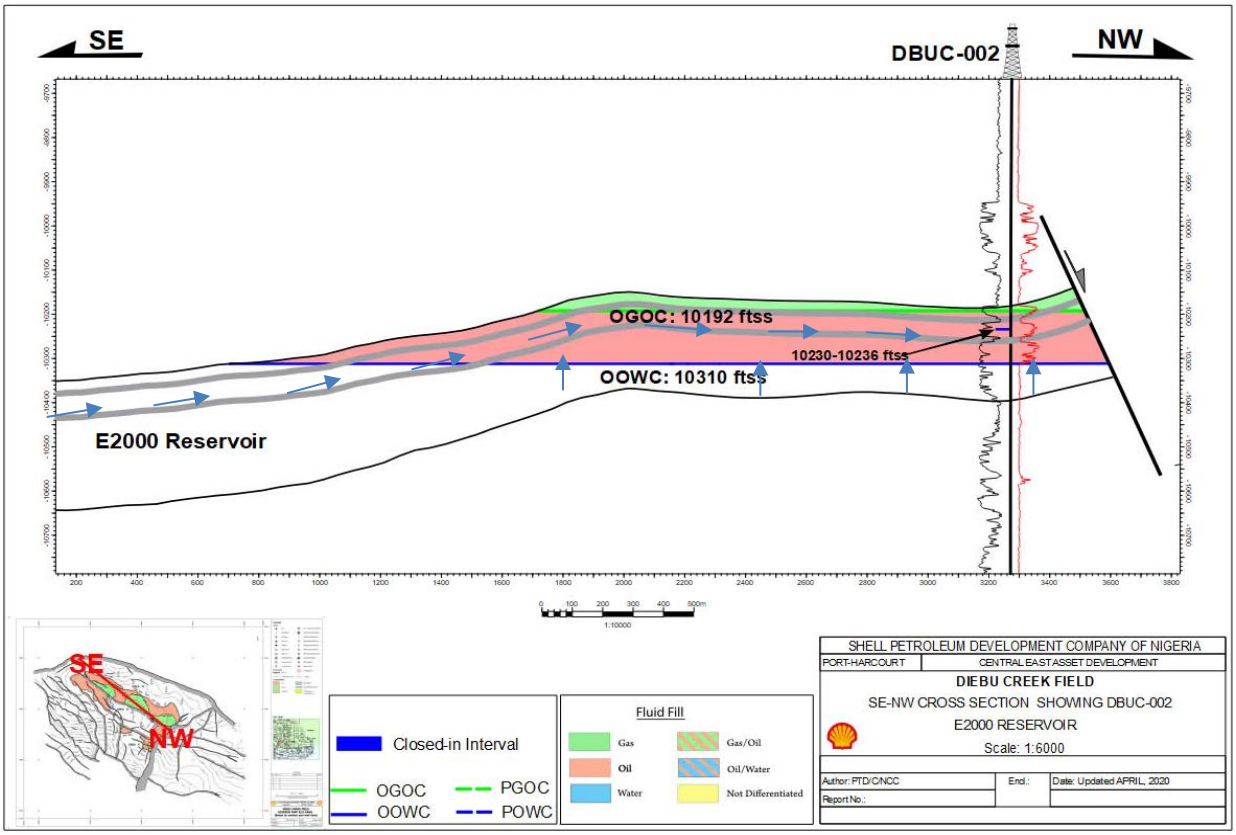
Appendix 9: E2000 Top Structure Map



Appendix 10: Correlation Panel Thro' DBUC002T & 011T on E2000N Reservoir



Appendix 11: Structural Cross Section Through DBUC002T on E2000N Reservoir



Appendix 12: H_2S Prediction

Diebu Creek 002T H_2s Prediction For E2000N Reservoir

- Diebu Creek 002 is completed as a SSS oil producer on the E2000 sand.
- This interval (DBUC002T) is proposed for nitrogen lift, water shut-off and perforation extension on the E2000N reservoir.

PVT Report and Production History

- There is PVT report for the E2000N reservoir from DBUC011T. This report indicates that the H_2S estimated in the reservoir fluid and gas separator analysis is zero (See snapshot of PVT report on the next slide).
- No H_2S has been produced from the E2000N reservoir to date.

Souring Potential

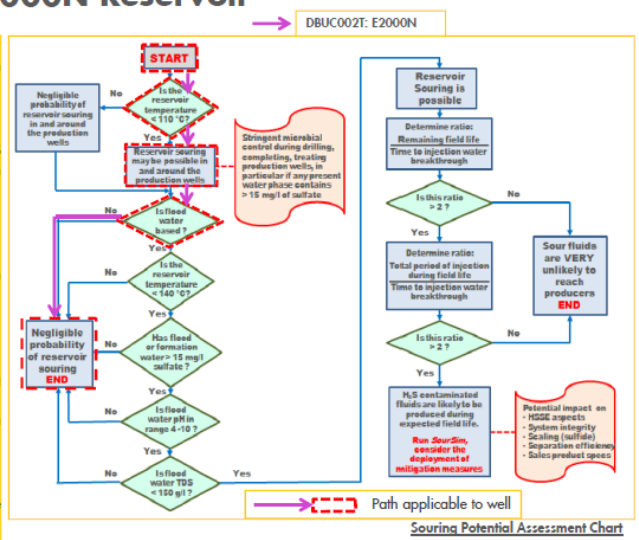
- The consequence of H_2S is loss of life and material integrity. However, available PVT data in Diebu Creek and nearby fields do not indicate H_2S presence.
  - The maximum reservoir temperature for the target sand (E2000N) is 87.7 °C (below 110°C)
  - No water injection in Diebu Creek & nearby fields that can lead to reservoir souring.
  - No secondary or tertiary recovery processes are being practiced in the field.
- Also, due to these reasons the souring tendency of the reservoir is minimal (refer to the souring potential chart in attachment1).
- The fresh-saline water interface in DBUC002T is ~5030ftss, which is about 5150ftss away from the E2000N reservoir. The possibility of fresh water migration into this reservoir (E2000N) is low.

External Risks

- There is a risk of the Equipment (e.g. CT, Tanks) to be used in this operation, introducing some H_2S based on residue from their previous operations reacting with the acid to be used now.

Mitigations

- Check and Confirm that previous use of the equipment would not intentionally give rise to H_2S after contacting HCL.
- H_2S Gas monitors will be utilized during Well Intervention execution to alert the crew of any latent threats.
- Appropriate PPE's to be worn as mitigation. Abort operation if H2S monitor shows concentration >50 ppm.



Souring Potential Assessment Chart

Date	14th July 2020	
Prepared by	Imaobong Bassey (PG)/ Eelah Muzan(PT)/ Onajite Taro (PT)/ Dike Ahunanya (PP))/ Abdul-wahab Sa'ad (RE)	
Approved by	Tamunotonye Biambo (PT TA2)	Tammy Biambo Digitally signed by Tammy Biambo Date: 2020.07.21 17:02:33 +01'00'
Approved by	Ubong Etuk (PG TA2)	Etuk, Ubong A. Digitally signed by Etuk, Ubong A. Date: 2020.07.21 09:16:34 +01'00'

PVT Analysis Result For Diebu Creek E1000 Reservoir

- PVT samples taken from the E2000N reservoir in DBUC011T indicates no H2S present.
- Separator liquid and gas samples analysis indicates that there is no H2S present in the reservoir.
- No H2S production has been recorded till date from Diebu Creek Field.

client : SHELL PET. DEV. COY. OF NIG. LTD. | page : 5
well : DIEBU CRK. #11T / E2.00N | report no : PVT96018 | sampling date : 29/03/96

FIELD SEPARATOR GAS ANALYSIS

Molecular composition (mole per cent)

1. CONDITIONS				
Cylinder No.		A-9712	A-14(5)	A-13435
Separator Press (psia)		175	175	175
Separator Temp (degF)		93.2	93.2	86.0
2. COMPOSITION (mole per cent)				
Non_hydrocarbons				
Nitrogen	N_2	0.06	0.14	0.15
Carbon Dioxide	CO_2	0.36	0.35	0.34
Hydrogen Sulphide	H_2S	0.00	0.00	0.00
Hydrocarbons				
Methane	CH_4	81.19	81.20	80.81
Ethane	C_2H_6	8.59	8.62	8.69
Propane	C_3H_8	6.07	6.06	6.20
i_Butane	iC_4H_{10}	1.28	1.27	1.33
n_Butane	nC_4H_{10}	1.54	1.53	1.58
i_Pentane	iC_5H_{12}	0.37	0.37	0.37
n_Pentane	nC_5H_{12}	0.29	0.30	0.31
Hexanes	C_6H_{14}	0.13	0.11	0.16
Heptanes plus	$C_7H_{16}+$	0.11	0.05	0.12
Total		100.00	100.00	100.00
3. PHYSICAL PROPERTIES				
Molecular Weight		20.805	20.744	20.898
Molecular Wt C7+		108.6	107.3	105.8
Density g/cm3		8.781e-4	8.756e-4	8.821e-4
Rel Density air=1		0.718	0.716	0.721
Viscosity cP		0.0111	0.0111	0.0110
Heat Content BTU/scf		1254.3	1254.3	1262.7
4. LIQUID CONTENT				
C3+ gal / Mscf		2.947	2.869	2.973
C4+ gal / Mscf		1.256	1.206	1.274
C5+ gal / Mscf		0.332	0.312	0.345

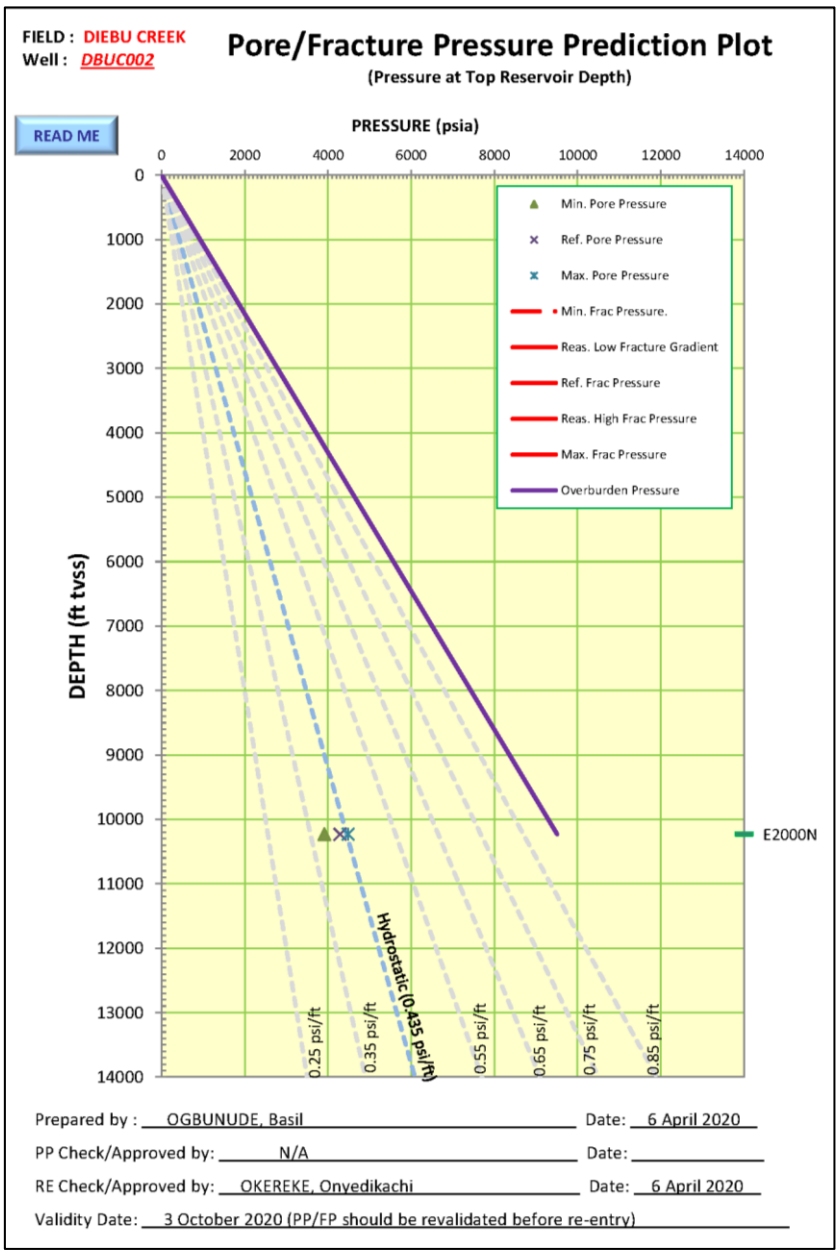
client : SHELL PET. DEV. COY. OF NIG. LTD. | page : 10
well : DIEBU CRK. #11T / E2.00N | report no : PVT96018 | sampling date : 29/03/96

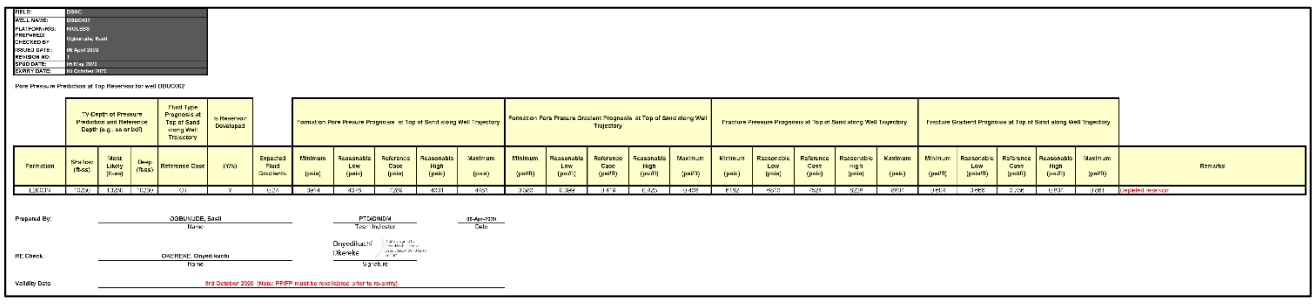
RESERVOIR FLUID ANALYSIS

1. COMPOSITION (mole per cent)				
		SEPARATOR LIQUID	SEPARATOR GAS	RESERVOIR FLUID
Non-hydrocarbons				
Nitrogen	N_2	0.00	0.14	0.08
Carbon Dioxide	CO_2	0.04	0.35	0.22
Hydrogen Sulphide	H_2S	0.00	0.00	0.00
Hydrocarbons				
Methane	CH_4	3.61	81.20	49.23
Ethane	C_2H_6	1.87	8.62	5.84
Propane	C_3H_8	5.29	6.06	5.74
i_Butane	iC_4H_{10}	3.11	1.27	2.03
n_Butane	nC_4H_{10}	7.59	1.53	4.03
i_Pentane	iC_5H_{12}	4.90	0.37	2.24
n_Pentane	nC_5H_{12}	5.31	0.30	2.36
Hexanes	C_6H_{14}	8.53	0.11	3.58
Heptanes	C_7H_{16}	6.09	0.05	2.54
Octanes	C_8H_{18}	14.34	0.00	5.91
Nonanes	C_9H_{20}	10.83	0.00	4.46
Decanes	$C_{10}H_{22}$	7.06	0.00	2.91
Undecanes	$C_{11}H_{24}$	5.51	0.00	2.27
Dodecanes plus	$C_{12}H_{26}+$	15.93	0.00	6.56
Total		100.00	100.00	100.00
Molar Ratio		0.4120	0.5880	1.0000
2. PHASE PROPERTIES				
Molar Mass fluid		110.11	20.79	57.55
Density Fluid : g/cm3				
Mole percent Heptanes plus		59.75	0.05	24.63
Molar Mass Heptanes plus		142.67	107.30	142.60
Mole percent Dodecanes plus		15.93		6.56
Molar Mass Dodecanes plus		192.44		192.37
Density Dodecanes plus : g/cm3				
Relative Density : air=1			0.716	

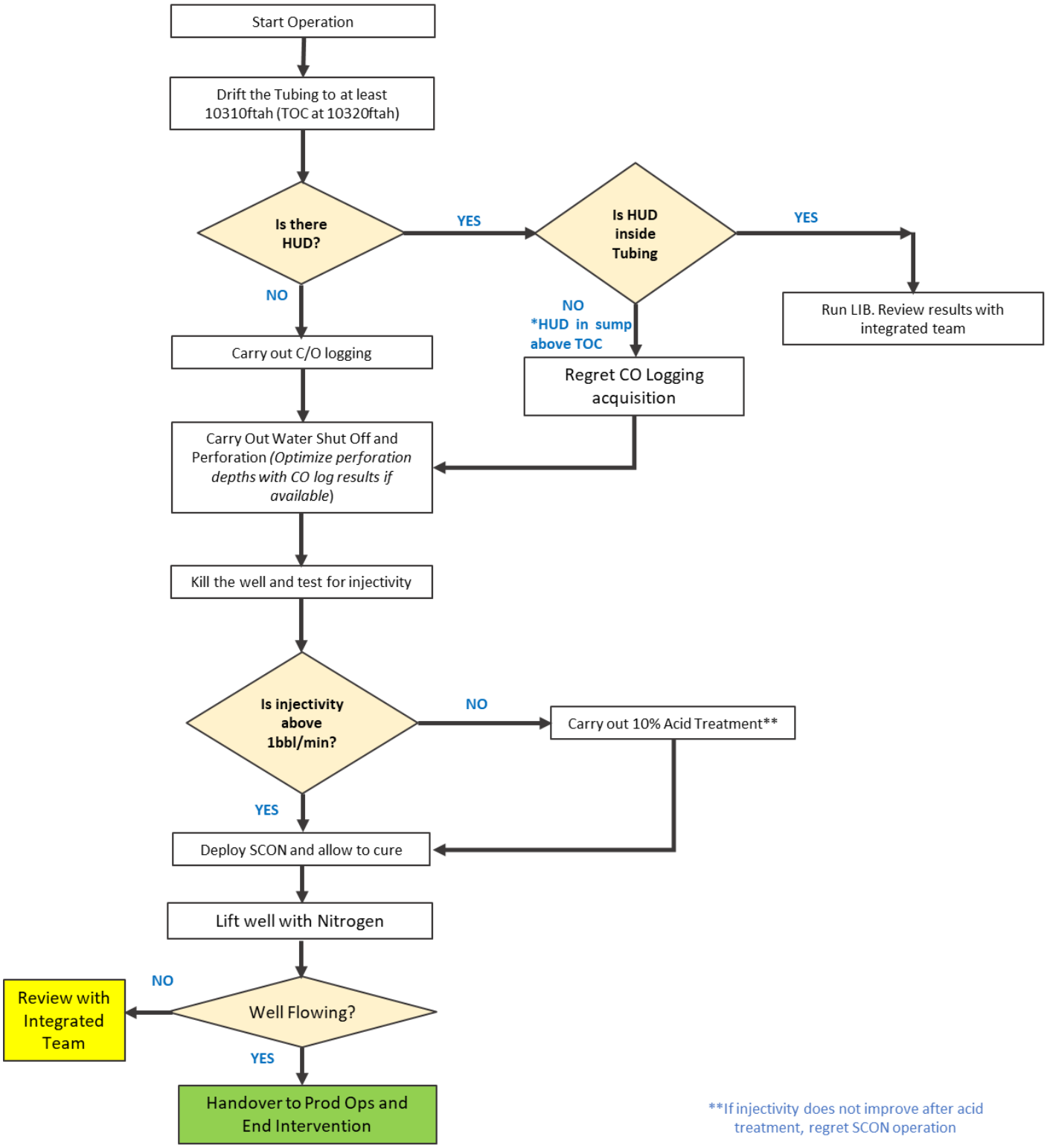
C7+

Appendix 13: Pore Pressure Prediction





Appendix 14: DBUC002T Intervention Decision Tree



**If injectivity does not improve after acid treatment, regret SCON operation

Appendix 15: Emergency Response Data

Emergency Data Set Content			Data Owners /Accountable Discipline	Names	Email
People contacts and Procedures	1	Duty roaster (weekend duty/leave plan)	Development – Planning Weekend duty Coordination	Akpovine Otughwor Eric Ezenobi	Akopovine.otughwor@shell.com Eric.C.Ezenobi@shell.com
	2	Emergency response contact details: Subsurface team, operations team, wells, OU and external emergency responders.	Soku/ Nun River Node FMT PT PP PG RE WRFM CWI Asset Engr.	Jonathan Mude Eelah Muzan Dike Ahunanya Imaobong Bassey Basil Ogbunude Esther Briggs Olugbenga Jimba	J.Mude@shell.com Eelah.Moro@shell.com Dike.Ahunanya@shell.com Imaobong.bassey@shell.com B.Ogbunude@shell.com Esther.Briggs@shell.com Olugbenga.Jimba@shell.com
	3	Diebu Creek 2020 STOG Proposals	Soku/ Nun River Node FMT PT PP PG RE WRFM CWI Asset Engr.	Jonathan Mude Eelah Muzan Dike Ahunanya Imaobong Bassey Basil Ogbunude Esther Briggs Olugbenga Jimba	J.Mude@shell.com Eelah.Moro@shell.com Dike.Ahunanya@shell.com Imaobong.bassey@shell.com B.Ogbunude@shell.com Esther.Briggs@shell.com Olugbenga.Jimba@shell.com
	4	Well tops and fluid fill interpretation	PG/PP	Imaobong Bassey/ Dike Ahunanya	imaobong.bassey@shell.com Dike.Ahunanya@shell.com
	5	Subsurface map	PG	Imaobong Bassey	Imaobong.bassey@shell.com
	6	Pore pressure prediction	RE/PP	Basil Ogbunude/ Dike Ahunanya	B.Ogbunude@shell.com Dike.Ahunanya@shell.com
	7	Intervention work scope	PT/WE	Eelah Muzan /Conrad Ibekwe	Conrad.ibekwe@shell.com Eelah.Moro@shell.com
	8	Correlation Panel	PG	Imaobong Bassey	Imaobong.bassey@shell.com
	9	Cross section through the STOG well.	PG	Imaobong Bassey	Imaobong.bassey@shell.com
	10	Petrophysical logs for well & nearby wells	PP	Dike Ahunanya	Dike.Ahunanya@shell.com
	11	Worst Case Discharge	PT	Eelah Muzan	Eelah.Moro@shell.com
	12	Well Status Diagram	PT	Eelah Muzan	Eelah.Moro@shell.com
Overall responsible focal point for Duty and Emergency Response Files					
Name		Arnold Obomanu			
Contact Details		a.obomanu@shell.com / +2348070221066			

		Emergency Data Set Content	Update Timing	Medium/Location	Data Owners /Accountable Discipline
People contacts and Procedures	1	Duty roaster (weekend duty/ leave plan)	Annually/after staff rotations	Electronic/SharePoint and ERO Portal	Development - Planning
	2	Emergency response contact details: Subsurface team, operations team, wells, OU and external emergency responders.	After staff rotations	Electronic/ ERO Portal	ERT
	3	Communication Protocol	No special communication protocol is required. This is a conventional operation that will be executed by in-house experts/ERO Portal		ERT
	4	ADIB004S Zone Change & Unsecuring Proposal	Dependent on availability of new information	Electronic/ Sirus Catalog DBUC002T Nitrogen Lift Proposal	PG/ PP/ RE/PT/WE
	5	Well tops and fluid fill interpretation		Electronic/CDS, ERO Portal	PG/PP
	6	Subsurface map		Electronic/DBUC002T Nitrogen Lift Proposal, ERO Portal and Sirus Catalog	PG
	7	Pore pressure prediction	6 months prior to activity	Electronic/DBUC002T Nitrogen Lift Proposal Valve Proposal Addenduml	RE/PP
	8	Intervention work scope	Dependent on availability of new information	Electronic/DBUC002T Nitrogen Lift Proposal and Sirus Catalog	PT/WE
	9	Correlation Panel			PG
	10	Cross section through the Workover well.			PG
	11	Petrophysical logs for well & nearby wells	Not Applicable	Electronic/RECALL, Hardcopy/Log Room	PP
	12	Worst Case Discharge	When Pore pressure prediction is updated prior to activity	Electronic/ DBUC002T Nitrogen Lift Proposal and Share point	PT
	13	Well Status Diagram	Dependent on availability of new information	Electronic/EDM, Sirus Catalog & DBUC002T Nitrogen Lift Proposal	PT

Overall responsible focal point for Duty and Emergency Response Files	
Name	Arnold Obomanu
Contact Details	a.obomanu@shell.com / +2348070221066