Nano Graphene Engineered Lubricant For Drilling Fluids

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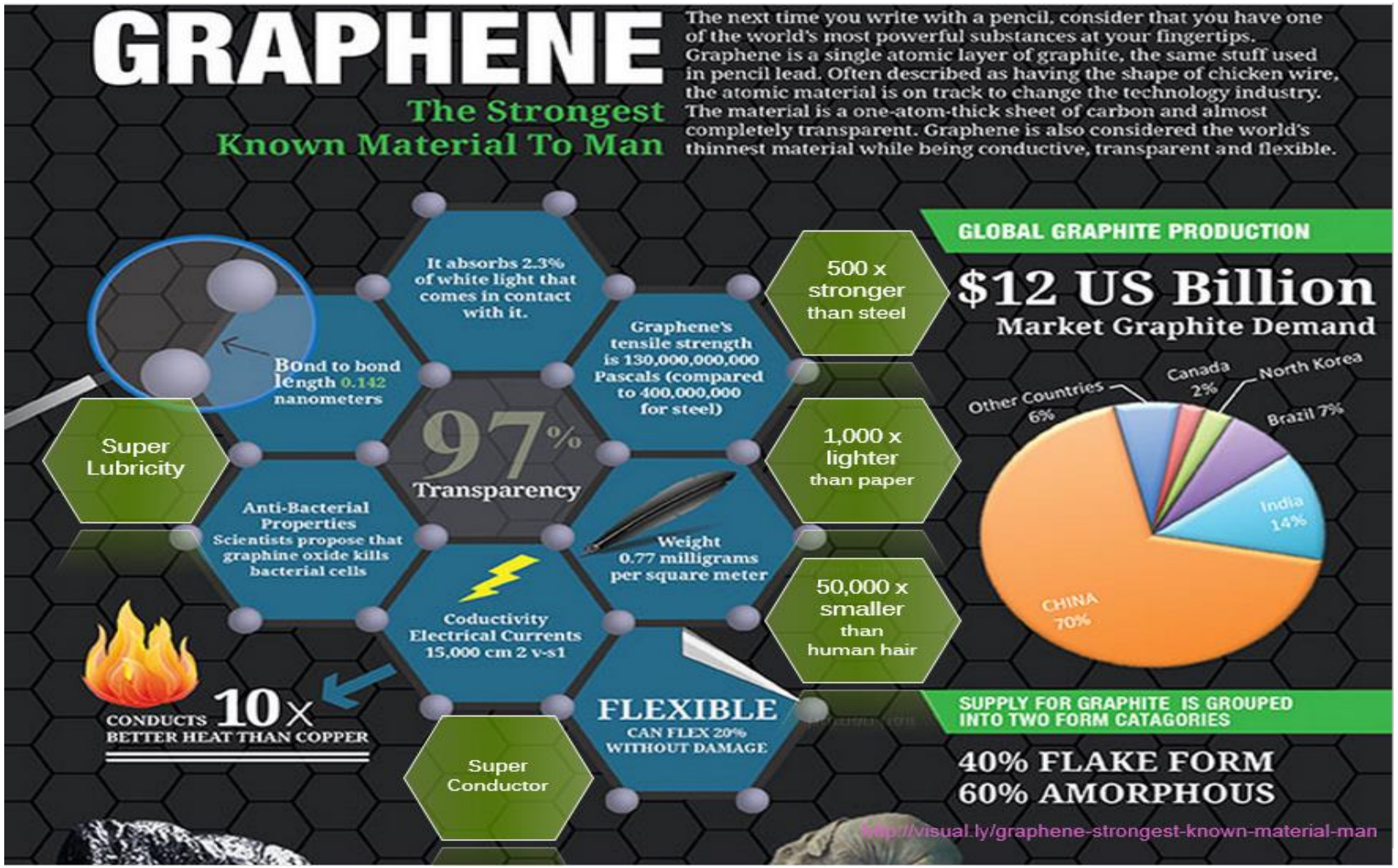
GRAPHENE
The Strongest Known Material To Man
The next time you write with a pencil, consider that you have one of the world's most powerful substances at your fingertips. Graphene is a single atomic layer of graphite, the same stuff used in pencil lead. Often described as having the shape of chicken wire, the atomic material is on track to change the technology industry. The material is a one-atom-thick sheet of carbon and almost completely transparent. Graphene is also considered the world's thinnest material while being conductive, transparent and flexible.
It absorbs 2.3% of white light that comes in contact with it.
Graphene's tensile strength is 130,000,000,000 Pascals (compared to 400,000,000 for steel)
500 x stronger than steel
Bond to bond length 0.142 nanometers
Super Lubricity
97% Transparency
1,000 x lighter than paper
Anti-Bacterial Properties Scientists propose that graphine oxide kills bacterial cells
Weight 0.77 milligrams per square meter
Coductivity Electrical Currents 15,000 cm 2 v-s1
50,000 x smaller than human hair
CONDUCTS 10X BETTER HEAT THAN COPPER
FLEXIBLE CAN FLEX 20% WITHOUT DAMAGE
Super Conductor
GLOBAL GRAPHITE PRODUCTION
$12 US Billion
Market Graphite Demand
Other Countries 6%
Canada 2%
North Korea
Brazil 7%
India 14%
CHINA 70%
SUPPLY FOR GRAPHITE IS GROUPED INTO TWO FORM CATAGORIES
40% FLAKE FORM
60% AMORPHOUS
http://visual.ly/graphene-strongest-known-material-man

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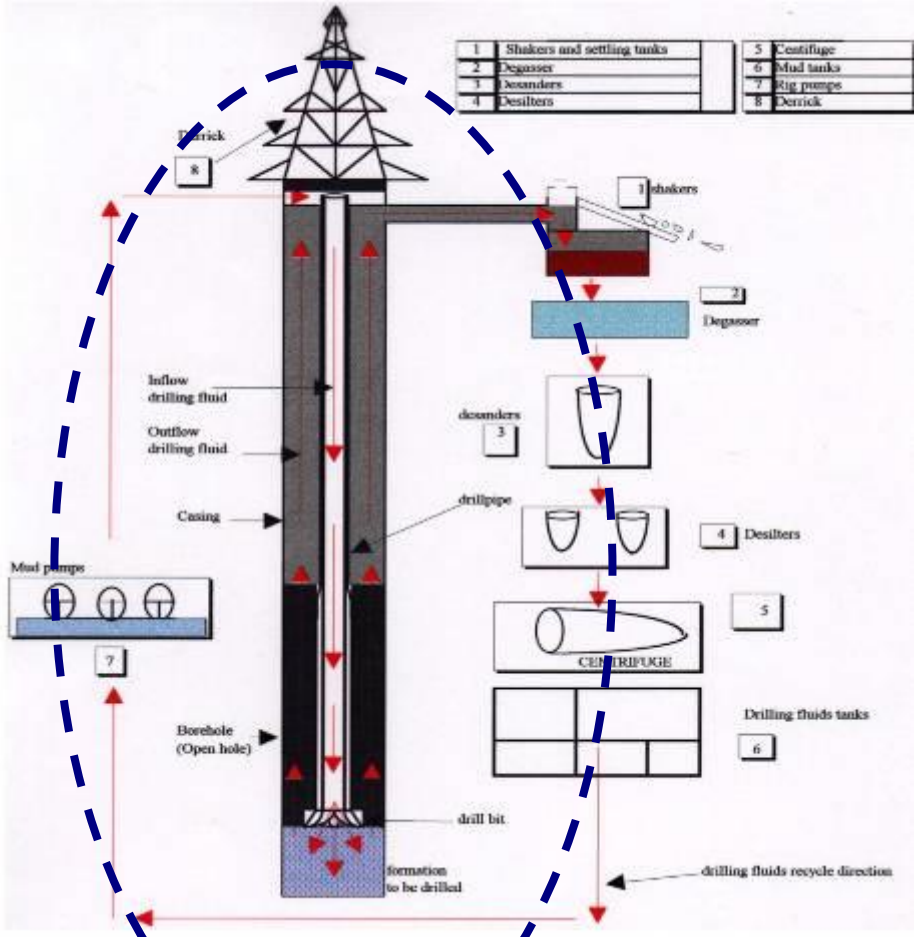
Process of Drilling & What Is Drilling Fluids?



Functions of Drilling Fluids (DF)

- To carry cuttings to the surface
- To balance formation pressure
- To cool and lubricate drilling bit and drill string
- To stabilise well bore
- To minimise reservoir damage
- To facilitate cementing and completion

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LUBRICANTS CURRENTLY AVAILABLE

- Lubricants for high mechanical friction
- Most liquid lubricants consist of ~70% solvents and 30% active component with and efficiency depends on drilling fluids types, solids content, well geometry, etc
- Solid lubricants (treated graphite, glass beads, copolymer beads, etc) to form slippery layer between borehole and tubular
- Coefficient of Friction (CoF) for typical SBM is <0.16, WBM is 0.2 – 0.6

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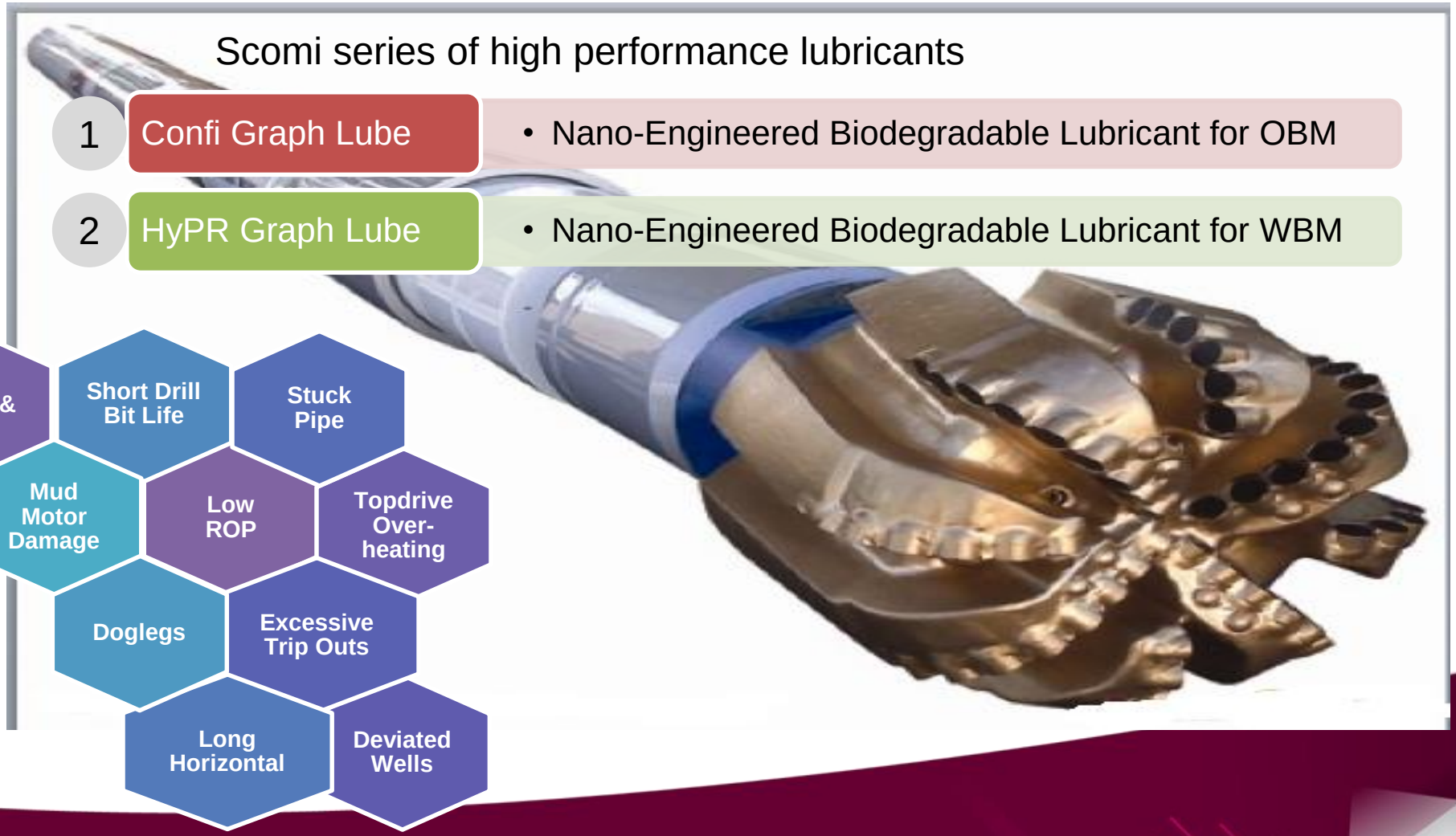
Drilling Issue & Scomi Solution



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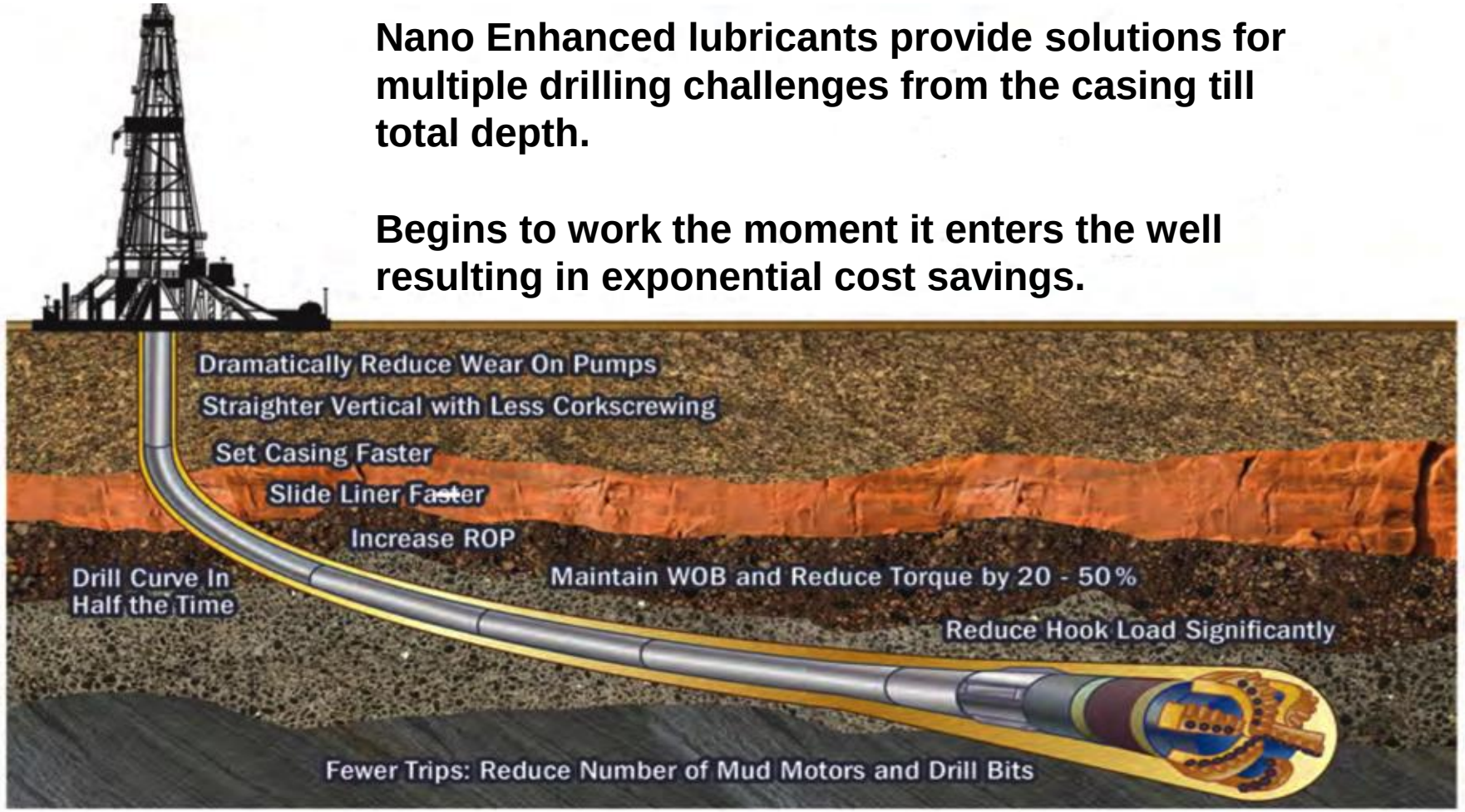
Solution to Drilling Challenges

Nano Enhanced lubricants provide solutions for multiple drilling challenges from the casing till total depth.

Begins to work the moment it enters the well resulting in exponential cost savings.



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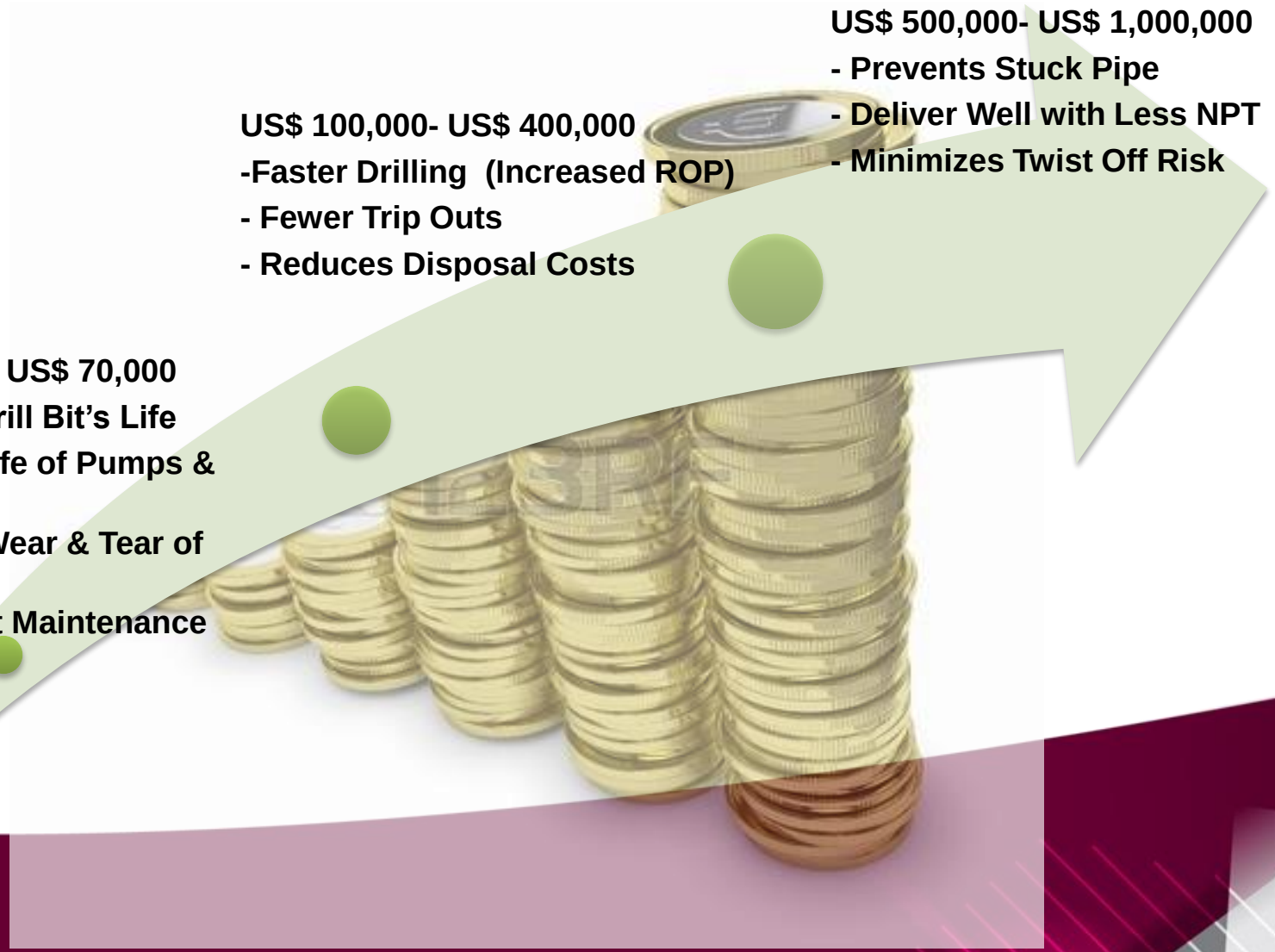
Typical Cost Savings



US$ 10,000- US$ 70,000

- Extends Drill Bit's Life
- Extends Life of Pumps & Motors
- Reduces Wear & Tear of Drill Strings
- Equipment Maintenance

US$ 100,000- US$ 400,000

-Faster Drilling (Increased ROP)
- Fewer Trip Outs
- Reduces Disposal Costs

US$ 500,000- US$ 1,000,000

- Prevents Stuck Pipe
- Deliver Well with Less NPT
- Minimizes Twist Off Risk

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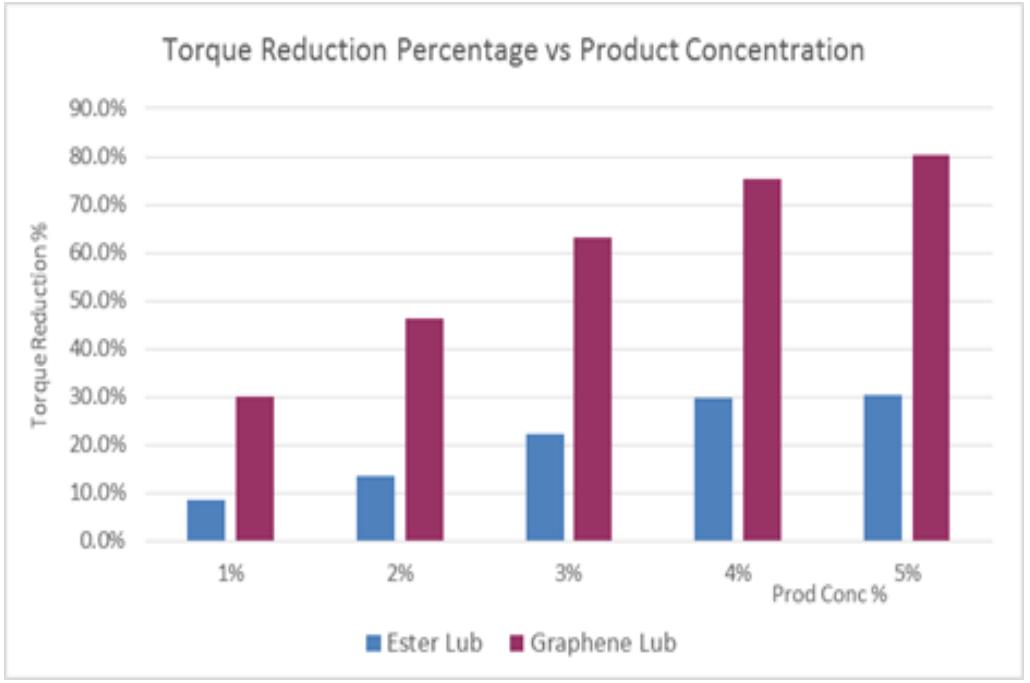
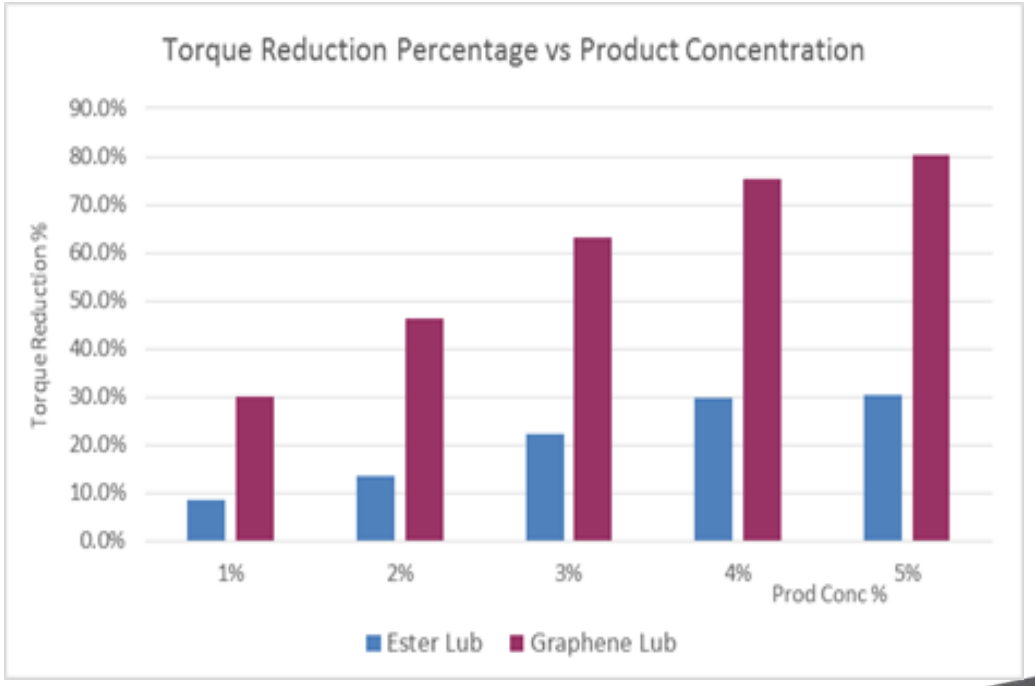
LABORATORY PERFORMANCE – 10 & 13.5ppg WBM





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LABORATORY PERFORMANCE – 13.5ppg WBM

Product	order	time	Base		T1: Graphene Lub		T2: T1 + Cement		T3: T1 + Citric Acid		T4: T1 + Caustic Soda	
Fresh water	1		267.84		267.84		267.84		267.84		267.84	
Sodium Carbonate	2	2	0.20		0.20		0.20		0.20		0.20	
Bentonite	3	5	4.00		4.00		4.00		4.00		4.00	
Sulphonated Copolymer	4	2	1.00		1.00		1.00		1.00		1.00	
Synthetic Resin Lignite	5	2	8.00		8.00		8.00		8.00		8.00	
Synthetic Polymer #1 for Fluids Loss	6	5	1.00		1.00		1.00		1.00		1.00	
Synthetic Polymer #2 for Fluids Loss	7	5	1.75		1.75		1.75		1.75		1.75	
Sodium Hydroxide	8	2	0.15		0.15		0.15		0.15		0.15	
MEA	9	2	2.00		2.00		2.00		2.00		2.00	
API Barite	10	5	261.29		261.29		261.29		261.29		261.29	
Drill Solids	11	5	20.00		20.00		20.00		20.00		20.00	
Lubricant	12	5			14.0mL		14.0mL		14.0mL		14.0mL	
Oxygen Scavenger	13	-	2.00		2.00		2.00		2.00		2.00	
Initial properties/AHR/ASA @ 350F	**Spec**		**BHR**	**AHR**	**BHR**	**AHR**	**BHR**	**AHR**	**BHR**	**AHR**	**BHR**	**AHR**
Mud density, S.G	13.5		13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Rheological properties at 120F				120F		120F		120F		120F		120F
600 RPM				105		110		95		81		103
300 RPM				67		70		57		50		63
200 RPM				49		54		41		40		49
100 RPM				29		35		25		26		32
6 RPM	8-12			5		15		5		11		15
3 RPM				4		14		4		10		14
PV, cP	<40			**38**		**40**		**38**		**31**		**40**
YP, lb/100 ft^2	15-28			**29**		**30**		**19**		**19**		**23**
Gel 10 sec, lb/100 ft^2	6-10			5		15		5		12		16
Gel 10 min, lb/100 ft^2				16		26		14		19		28
API Fluids Loss, mls	<3			2		2		6		7		3
pH mud	9-9.5			9.6		9.4		11.4		8.9		10.0
Lubricity test												
Mud Lubricity coefficient				0.25		0.07		0.16		0.16		0.07
Torque reduction, %						53.2		34.6		35.5		54.6

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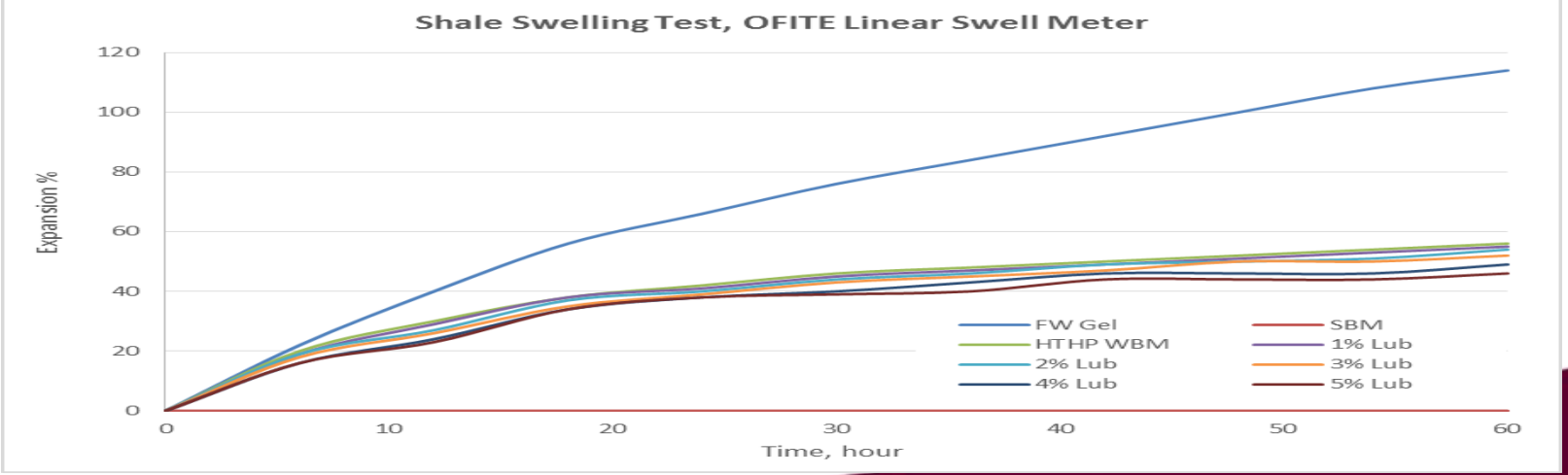
LABORATORY PERFORMANCE – 13.5ppg WBM

Product	Base	T1: 1% Graphene Lub	T2: 2% Graphene Lub	T3: 3% Graphene Lub	T4: 4% Graphene Lub	T5: 5% Graphene Lub
Fresh water	267.84	267.84	267.84	267.84	267.84	267.84
Sodium Carbonate	0.20	0.20	0.20	0.20	0.20	0.20
Bentonite	4.00	4.00	4.00	4.00	4.00	4.00
Sulphonated Copolymer	1.00	1.00	1.00	1.00	1.00	1.00
Synthetic Resin Lignite	8.00	8.00	8.00	8.00	8.00	8.00
Synthetic Polymer #1 for Fluids Loss	1.00	1.00	1.00	1.00	1.00	1.00
Synthetic Polymer #2 for Fluids Loss	1.75	1.75	1.75	1.75	1.75	1.75
Sodium Hydroxide	0.15	0.15	0.15	0.15	0.15	0.15
MEA	2.00	2.00	2.00	2.00	2.00	2.00
API Barite	261.29	261.29	261.29	261.29	261.29	261.29
Drill Solids	20.00	20.00	20.00	20.00	20.00	20.00
Oxygen Scavenger	2.00	2.00	2.00	2.00	2.00	2.00
Lubricant		3.5mL	7mL	10.5mL	14mL	17.5mL
Shale Recovery % (Pierre Shale)	**%**	**%**	**%**	**%**	**%**	**%**
Shale Recovery %	59.0	61.0	60.0	69.0	71.0	68.0



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LABORATORY PERFORMANCE – Formation Damage

WBM DIF, 11ppg	BASE	T1 - Graphene Lub	T2 - Ester Lub
Water	261.99	261.99	261.99
Sodium Formate	117.38	117.38	117.38
Clarified Starch	6	6	6
MEA	1	1	1
Clarified Xanthan Gum	1	1	1.5
Magnesium oxide	1	1	1
25 Micron CaCO3	15	15	15
50 Micron CaCO3	15	15	15
150 Micron CaCO3	20	20	20
Graphene Lubricant	-	10.5	-
Ester Lubricant	-	-	10.5
Coefficient of friction	0.2266	0.1442	0.1957
Lubricity Improvement		36.36%	13.64%
Initial Permeability, mD	1203		
Return Permeability, mD	60	497	591
Retained Permeability, mD	5	41	49

Table 5: Mud formulation, Coefficient of Friction Results, and Retained Permeability Results for the 11 lb/gal Drill-In Fluid, with 3% of lubricants

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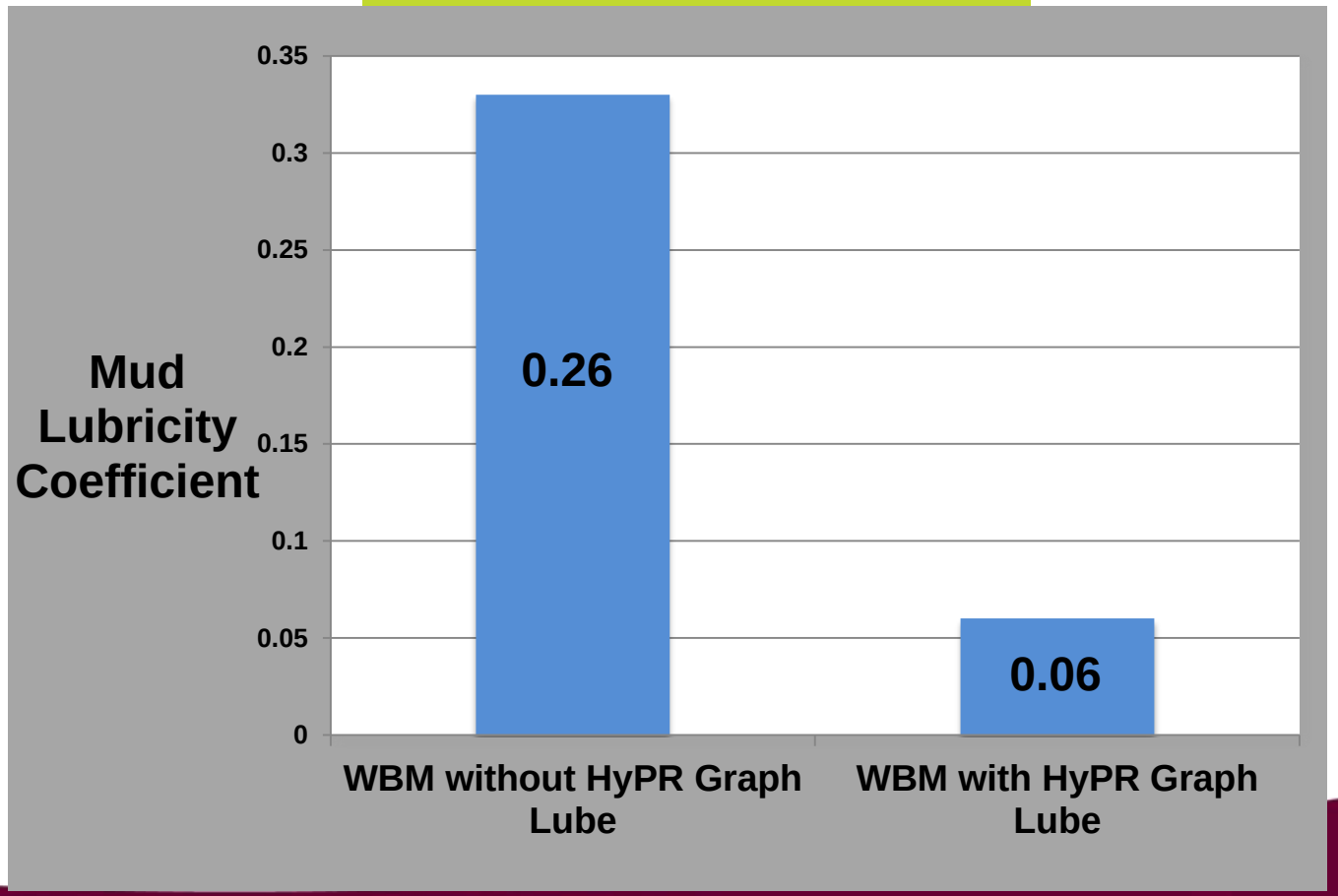
Lubricity Test

Torque Reduction



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Bearing Friction Test

Over 50 times more powerful than conventional lubricants !

With CONFI Graph Lube @ 200,000 psi

Without Confi Graph Lube @ 4000 psi

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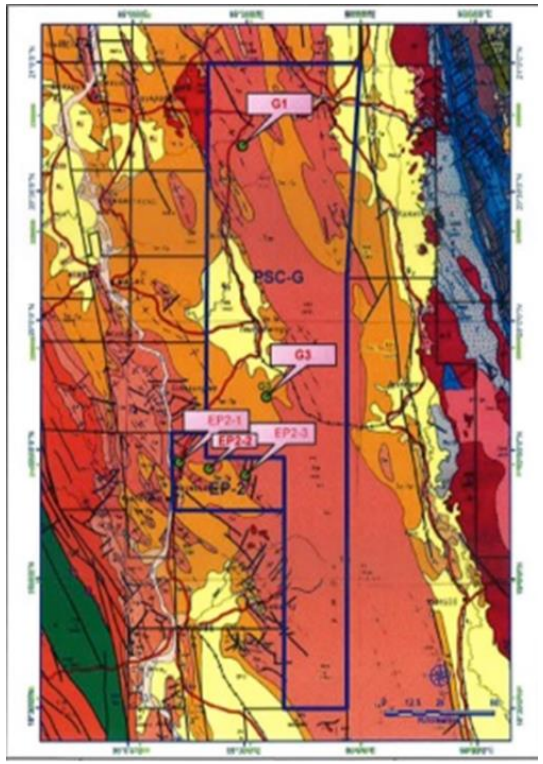
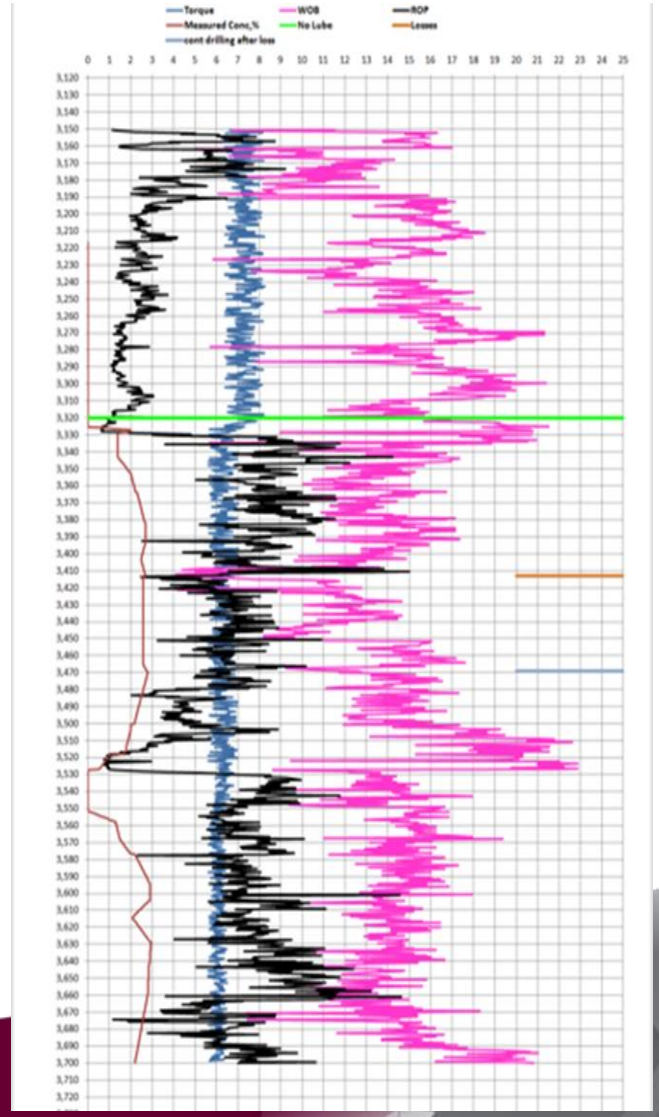
FIELD TRIAL PERFORMANCE

- Trial was conducted in 6” section of an onshore exploration well, where it’s hard formation with average 3-4m/hr ROP, 2-3 days of bits’ life spans
- With introduction of the product, noticeable reduction in torque, improvement in ROP
- Average lower WOB, but improved ROP





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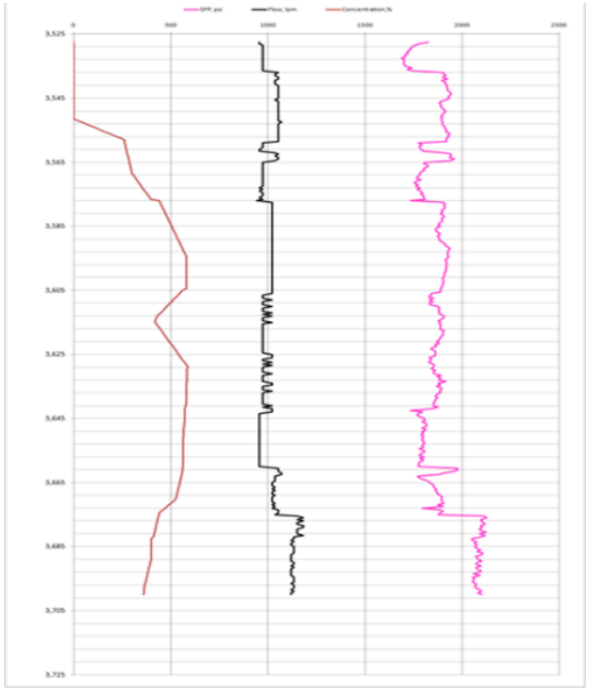
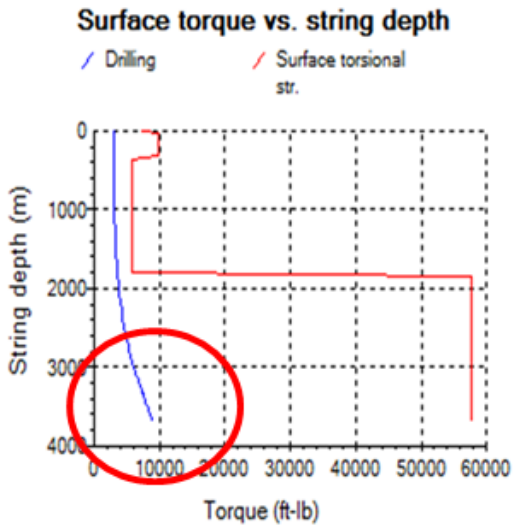
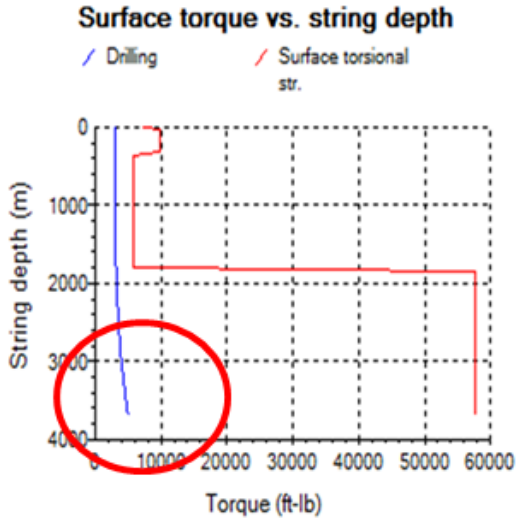
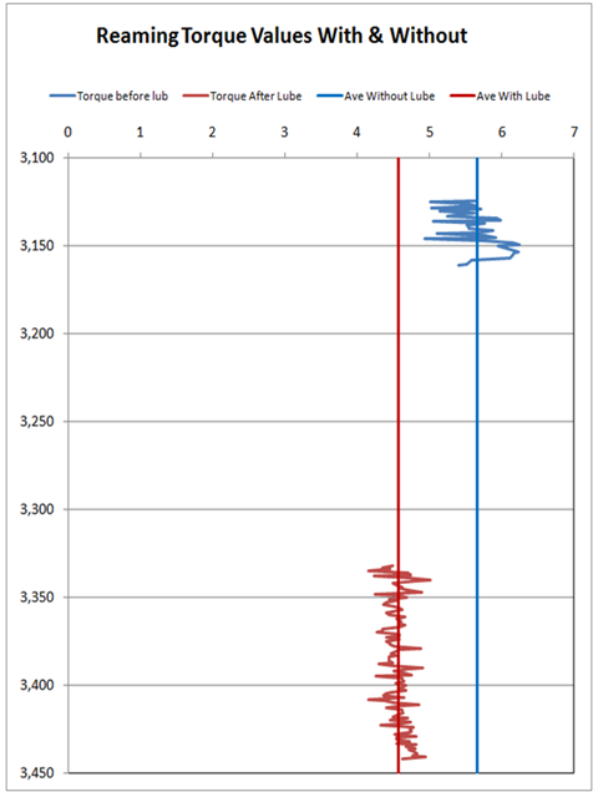
DRILLING PERFORMANCE









- SPP maintained with addition of the product
- Torque simulation showed 44% torque reduction with CoF changed from 0.21 to 0.08 (similar to SBM)
- Actual average reaming torque reduced 20%

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BIT OBSERVATION

- Elongation of bit life span from 3-4 days per bit to >7 days
- No bit balling observed, improved in torque and drag, ROP

Before product addition – bit worn out, solids remained on bit even after washed

After product addition – bit in good shape and no solids remained after washed

After product addition – no balling on BHA, easily to be cleaned

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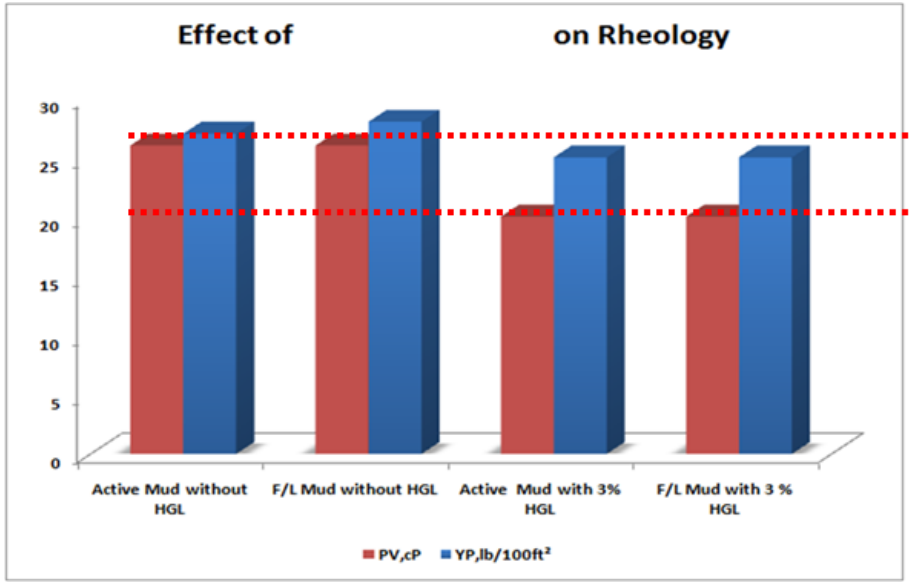
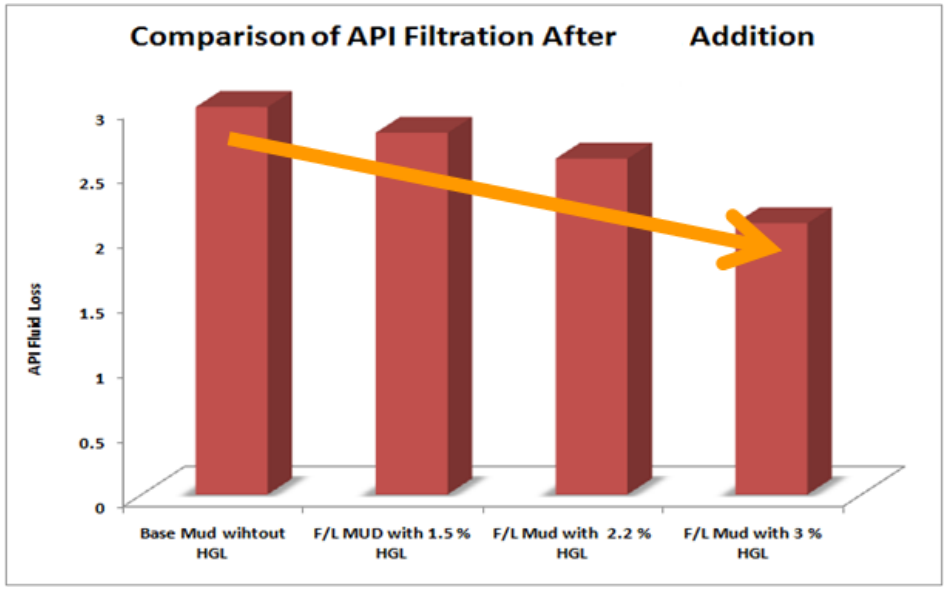
DRILLING FLUIDS PROPERTIES IMPROVEMENT





- PV reduced 23% & fluids loss reduced 30% after 3% addition of product
- Fluids loss control polymers concentration reduced 40% compared to previous offset wells
- Graphene enhanced product reduces localized heat generation, elongate life span of polymers at high temperature condition
- Static for >24 hours without deterioration, BHST recorded at 176C (349F), higher than anticipated temperature

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FIELD TRIAL PERFORMANCE SUMMARY

- CoF reduction from 0.21 to 0.08
- ROP improved from average 3-4 m/hr to 9 m/hr (max recorded 15 m/hr)
- No solids accretion on the BHA and improve bit life span from average 3-4 days to >7days
- Torque reduction 44% with CoF reduction, field recorded average reaming torque reduced 20%
- PV reduction 23%, fluids loss reduction 30%, 40% reduction in fluids loss control polymers concentration
- WBM treated with 3% of graphene enhanced product had been static for >24 hours, without deterioration at BHST 176C (349F)

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Thank You !
Questions?

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