INVITATION TO SUBMIT TECHNICAL AND COMMERCIAL OFFERS

Cementing Services

We hereby invite qualified and experienced companies to submit their technical and commercial proposals for the provision of Cementing Services in accordance with the scope of work outlined in the attached document.

Scope of Work Includes:

- Cementing operations for one re-entry well and two exploration wells located in the Ghadames Basin, Block 95/96.

- Supply and procurement of cement and blends, including additives and spacers tailored to each operation.

- Provision of cementing units equipped with dual triplex pumps (10,000 psi), mixers, displacement tanks, electronic and manual recording systems, and all necessary accessories.

- Deployment of qualified personnel with a minimum of 3 years of experience in cementing operations.

- Execution of laboratory tests for slurry design including compressive strength, rheology, fluid loss, and compatibility.

- Delivery of preliminary and final cementing programs, incident reports, and end-of-phase cementing reports.

- Compliance with Libyan safety and operational standards, including insurance and personnel protection obligations.

Submission Guidelines:

- Offers must be submitted in sealed envelopes waxed in red.

- Both technical and commercial proposals must be included.

- Pricing details must be confined to the commercial offer only.

- Deadline for submission: within five (5) days from the date of this announcement.

For full technical specifications and requirements, please refer to the attached document.

We look forward to receiving your proposals.

4.2 SPECIFICATIONS OF EQUIPMENT AND SERVICES PROVIDED BY THE CONTRACTOR

4.2.3 CEMENTING SERVICES

Table of contents:

4.2.3.1. Description of Works

In order to meet the Client's requirements, the Contractor must provide the following:

- Cementing works in accordance with the specifications issued by the Client.

This service must include, but is not limited to:

- Supply and procurement of cement and blend,
- All services, supervision, technical support, materials, supplies (products), equipment, transportation, and any other item necessary for the completion of this service,
- Provision of input, advice, technical procedures related to cementing various columns according to the drilling program, cement plugs, side track plugs, abundant plugs, or others,
- Precise provision of the Job Report detailing all aspects of operations relevant to the installation and use of the Contractor's equipment;
- Supply of cement slurries and spacer according to specifications and needs for each of the detailed cementing works below,
- For all proposed cement slurries, the quality of these slurries must be very stable over time to ensure perfect annular isolation throughout the life of the well.

4.2.3.2. Technical Specifications of Required Equipment

For cementing works, the Contractor must provide at least the following equipment exclusively or upon request (depending on the requirements of each operation):

- Cementing unit with two triplex pumps with a capacity of 10,000 psi and a slurry pumping rate of 10 Bbls/min, equipped with:
    - Recirculation mixer with a minimum capacity of 6 Bbls,
    - Two (02) graduated displacement tanks with a precision of 10 Bbls,
    - Electronic recorder of pressure, flow rate, and volume (real-time and graphically on paper),
    - Martin Decker recorder with a range of 0 – 10,000 Psi,
    - Backup mixing system (jet mixer),
    - All power units must comply with regional specifications detailed in the unit's user manual. All systems must be designed and installed to meet standards,
    - The cementing unit must be equipped with an electronic tracking and recording system capable, at a minimum, of continuously providing pressure, flow rate, and density and providing a permanent copy for evaluation,
    - Recording and tracking system for slurry solids percentage.

Note :

- The minimum performance of the cementing package shall include:
    - Minimum service pressure of 10,000 psi,
    - Pumping rate of 2 Bbls/min at 5,000 psi,
    - Capability to mix a density of 16 ppg class G slurry at a rate > 5 Bbls/min,
    - Storage silo with a capacity of 200 tons of cement or cement blend equipped with a compressor and dust extractor,
    - Valves and connections (Service pressure at 10,000 psi), necessary for cement mixing and pressure testing,
    - Mixing tank with a minimum volume of 25 Bbls for normal casing or plug placement operations, and two tanks (2 x 50 Bbls) for production liners and casings; equipped with agitators, dry chemical injection ports, and centrifugal pumps,
    - Displacement tanks must have graduations showing real volumes, including reserve volume,
    - Displacement tanks must be equipped with a homogenization system or equivalent agitation system,
    - One (01) high-quality balance providing a true density measurement.

4.2.3.3. Cementing Equipment :

N°	COMPANY REQUIREMENT AND SPECIFICATION	CONTRACTOR SPECIFICATION
1.0	**CEMENT STORAGE TANK/SILO** For cement storage with a minimum storage capacity of 1000 cuft, skid mounted, complete with the following features: - Relief valves - Associated manifolding and shipping lines - Rock catchers Tank meets applicable Vessel Design Code Specification.	- Quantity: … - Dimension of Tank: …….. - Weight: …… - Total capacity: …….. m^3 Briefly describe features of Cement Storage tank/Silo: - Max.working pressure: …. Mpa - Normal working pressure:….Mpa - Cement exhaust rate: ……t/min Tank meets applicable Vessel Design Code Specification.
2.0	**AIR COMPRESSORS AND CUTTING TANK** Air compressors (L.P) for bulk cement plant at work site. Capable to operate at 351L/min @ 100 psi and able of shipping cement from bulking facilities to cementing unit. The compressor is fitted with the following Features: - Relief valves - Heat exchanger type dryer for keeping moisture out of P-tanks, lines, etc. - Associated manifolding enabling compressor to individually operate each bulk plant - Cutting tank equipped with cutting table for sack material at work site.	- Quantity: …… set - Make and model: ……. - Operating rate: ….m3/min @ 100 psi - Briefly describe features of Air Compressor: - Rating rev: ….tr/min; - Max working pressure: …..MPa. Meets the company specification

3.0	**CEMENT PUMPING UNIT** Skid/Truck mounted twin pump cementing unit, 10,000 psi WP, Has total maximum hydraulic Horse power of 500hhp, Equipped with plungers to operate at a pump rate of at least 5-6 BPM and 8000 psi discharge, diesel powered equipped with overspeed shutdown, water cooled and insulated exhaust manifold. The unit is equipped with 2x 10 Bbls displacement tank, circulating mixer and 45 cuft of cement surge tank complete with: - Cementing manifold from pump to cement and testing lines - Pulsation dampener - Centrifugal charge pump to pressurize cement pump section - Cement mixer capable of mixing high density cement - Control console with pressure gauges, pump rate meter and barrel - Counter for each pump - Built in with Air Compressor - One-double pen pressure recorder with 0-10000 psi working pressure - Recirculating mixing unit with Automatic density control - Computer for monitoring / data acquisition system The cement pump will be used for: - Primary & remedial cementing work - Pressure testing up to 7000 psi - Plug and abandonment - General pumping operation.	Skid-mounted twin pump cementing unit - Quantity: …. Sets - Pump make and model: ….. - Stroke length: ….. - Diameter of plunger: ….. - Input power: ….. - Weight: ….. - Current Maximum working pressure: ….. - Maximum pumping rate: ….. - Engine's make and model & horse power: ….. - No & capacity of displacement tanks: ….. - Overall Dimensions(L*W*H): ….. <u>Mixing pump</u>: <u>Suction charge pump</u>. - No & Type: ….. - Make & Model: ….. - Size&capacity: ….. - Maximum mixing capacity: ….., Maximum mixing rate: ….. - Specify no, make and model: - Non-Radioactive densiometer: ….. - Pressure recorder: ….. - Pump flow meter: ….. - Additional feature of the cementing unit (describe briefly)…..…….
4.0	**STEEL PUMPING LINES** Steel pumping lines 2" x 10000 psi WP chiksan complete with WECO hammer union 1502, with sufficient straight sections, pup joints, adapters, flexible chiksan loops and double wing swing joints.	- Quantity : ….. - Treat iron type, size and pressure rating: ….. - Chiksan type, size and pressure rating: ….., Meet the company specification
5.0	**CEMENTING HEAD** Surface cementing head system for the following casing, complete with associated accessories: Size Type Connection a)13''3/8 Double Plug BTC b)9''5/8 Double Plug Premium/BTC	Quantity : ….. List down surface cementing head to be provided: Size & connection: Size Type Connection a)13''3/8 Double Plug BTC b)9''5/8 Double PlugPremium/BTC
6.0	**CASING CIRCULATION HEAD** Casing swages with 2" WECO 1502 5,000psi WP. Chiksan line connection for the following casing: Size Type Connection a)13''3/8 Double Plug BTC b)9''5/8 Double Plug Premium/BTC c) 7'' Double Plug Premium	Quantity: ….. List Casing swages to be provided: Size, connection and quantity: Size Connection a)13''3/8 BTC b)9''5/8 Premium/BTC c) 7'' Premium

7.0	**PLUG VALVES** Size 2" x 2" WECO model DR-150 or equivalent, 10,000 psi WP With WECO 1502 or equivalent.	Size, pressure rating and type: …..
8.0	**CEMENT TESTING INSTRUMENT** Cement laboratory with the following minimum facilities: 1) HPHT Filtration test apparatus for slurry 2) Normal mud balance for measuring cement slurry weight 3) HTHP Consistometer (Thickening time) 4) Warning mixer/blender 5) Hot water bath for checking surface cement sample complete with thermometer 6) Atmospheric consistometer 7) Variable speed consistometer 8) Compressive strength COMPANY propose cement laboratory to be located at work site	
9.0	Mix water storage tank with recirculation system, 2 X 250bbl	Quantity: ….. Type:GJSG40-C,Capacity: …. Weight: ….. Dimension(L*W*H): …. Driling Liquid Agitator: No&Type: ….. Dimension: …. Iuput power: …..
10.0	Spacer tank with recirculation system,1X 250 Bbls	- Quantity: ….. - Type: …..,Capacity: …. - Weight: ….. - Dimension(L*W*H): …. - Driling Liquid Agitator: - No &Type: ….. - Dimension: …. - Iuput power: ….. - No &Type: …..: - Capacity: ….Speed: …. - Head>8m,Power: …..

NO	COMPANY REQUIREMENT AND SPECIFICATION	CONTRACTOR SPECIFICATION	Remark
1.0	HPHT Filtration test apparatus for slurry	Quantity : …..Model: ….., Made …. HPHT Filtration test apparatus for slurry Max. working pressure …..; Max .working temp…..	
2.0	Mud balance for measuring cement slurry weight	Quantity : ….. Made …. Pressurized mud balance for measuring cement slurry weight Range of measuring: ….	
3.0		Quantity : ….. model: ….,	

	HTHP Consistometer (Thickening time)	Made …... HTHP Consistometer Max. Working pressure …..; Max. Working Temp…..	
4.0	Warning mixer/blender	Quantity : ….. Model: …... Warning mixer/blender Range of rotating speed: …..; capability: …..	
5.0	Hot water bath for checking surface cement sample complete with thermometer	Quantity : …..Model : …... Hot water bath for checking surface cement sample complete with thermometer: Max. temperature: …..	
6.0	Atmospheric consistometer	Quantity : ….. Model: ….. Power: ….. Max working temperature: ….. Slurry cup rotating rate: …..	
7.0	Variable speed consistometer	Quantity : ….. Model: ….. Rotating Range: ….. The range of shear stress: ….. Power: …..	
8.0	Compressive strength	Quantity : ….. Model ….. Made ….. Compressive strength Range of pressure: …..	

Other Equipment

Item	**Specification Minimum**	**Spécification proposée**	**Année de fabrication**
1	13''3/8 BTC Double Plug Container Head	5000 PSI	
2	9''5/8 Premium/BTC Double Plug Cement Head	5000 PSI	
3	13''3/8 BTC Circulating Head	5000PSI	
4	9''5/8 Premium/BTC Circulating Head	5000PSI	
5	Top drive Circulating equipment for 13"3/8 BTC casing	YES	
6	Top drive Circulating equipment for 9"5/8 Premium/BTC	YES	
7	Top drive Circulating equipment for 7'' Premium	YES	
8	Top drive Circulating equipment for 4-1/2" Premium	YES	

Note:

- This equipment must be available with their accessories.

4.2.3.4. Technical staff :

For each cementing or pumping operation, the Contractor will assign qualified, technically competent, and experienced personnel for the works under this Contract.

The cementing operator must :

- Have at least 3 years of experience in the field. The number of years of experience should only consider the period during which they worked as a holder; the training period should not be considered as experience. Provide the CV.
- The standard cementing team consists of (see table a).

a- Table: Composition of cementing teams

DESIGNATION					
	20''	13''3/8	9''5/8	7''	$4^{1/2}$''(Option)
CIMENTING TEAM					
Operator	1	1	1	1	1
Assistant Operator	1	1	1	1	1
Laborer	4	4	4	4	4
Total	6	6	6	6	6
REDUCED TEAM FOR TESTING, CEMENT PLUGS					
Operator	1	1	1	1	1
Laborer	2	2	2	2	2
Total	3	3	3	3	3
ON-DEMAND PERSONNEL					
Supervisor or Engineer	1	1	1	1	1
Total	1	1	1	1	1

NB: Liner $4^{1/2}$'' is a contingency plan to solve any unexpected problem

Note :

- Additional personnel provided by the Contractor will be considered part of the team and therefore will not incur additional billing.
- The Contractor will provide the list of proposed personnel for the operator position (attach CV).

Nbr	**Name Surname**	**Name Surname**	**Name Surname**	**Name Surname**
01				
02				
03				
...				

- *Current Deployment Location

Item	**Designation**	**Activity**	**Unit**	**Payement Method**

01	Specialist Engineer (2)	Contractor's Regime	Day	Worked days excluding relief days
			Day	
02	Operational Team (Job Site)	Operation	Day or fraction	For operation time (1)
		Transport	KM	
		Standby	Jour	Presence period on site (1)
In the case of a monthly lump sum rental				
03	Operational Team (Job Site) Monthly Rental	Operation	Month or fraction	For time spent on Rig in activity
		Transport	Km	Movement between two platforms (1)

Note :

- (1) In case the Contractor performs works on a Lump Sum basis, its charges will not apply.

4.2.3.5. Cementing Products

a. List of Cement Additives (the list is not exhaustive)

Serial No.	Name & Type	Remarks
1	Class G cement	
2	Silica Blend	
3	Barite	
4	Heavy Blend	
5	Difoamer	
6	Calcium Chloride	
7	Sodium Chloride	
8	Anti Gas Migration stabilizer	
9	Silica Flour	
11	Silica Sand 100 Mesh	
12	Micro sillica	
13	Micro Fiber	
15	Expansion add	
16	Retarder-Low	
17	Retarder-Med	
18	Retarder-High	
19	Dispersant	
20	Anti-Gas Migration AGM	
21	Fluid Loss -Med	
22	Fluid Loss -High	
23	Micro sphere/Cenosphere	
24	Flexible Material for Integrity Stone	
25	Hematite	
26	Micromax	

27	Micro Fine Cement	
28	HEC Polymer	
29	Spacer Mix	
30	Surfactant Agent	
31	Mutual Solvent	

b. Cement and Additives Manual

The Contractor must :

- Have all manuals corresponding to the cements and additives that will be used in the well.

c. Physico-chemical properties of cement and additives:

ITEM	PHYSICAL AND CHEMICAL INDEX
appearance	
Density, g/cm^3（20±2C）	
Fineness%（residues on sieve 0.85mm ）	
Solubility in water	

d. Technical Properties :

ITEM		TECHNICAL INDEX
compressive strength, MPa （113°F (45℃),0.1MPa）	6h	
	12h	
	24h	
thickening time, min （113°F (45℃),18MPa）		
initial consistency, Bc		
Composition:		

e. USAGE :

- Application temperature range：……
- Dosage： ……

f. Packaging :

- Packaging Mode……

g. Others :

……

h. Description of Cement Additives : ……

i. **Payment Method**

For all cementing systems (slurries), the payment method for products is defined as follows:

Item	Designation	Activity	Unit	Remuneration
01	Cement /blend	Consumption	Tonne	Quantity consumed (used in the well)
02	Solid Products	Consumption	Kg	Quantity consumed (used in the well)
03	Liquid Products	Consumption	Litre	Quantity consumed (used in the well)

- For works on a Lump Sum basis, cement products as programmed in accordance with the technical program are included in the lump sum and will not be billed separately.
- In case of cancellation of a job by the Client, the products that would be mixed at the surface will be billed.
- Products that are discarded, before or after mixing, or declared unusable after mixing due to the Contractor's responsibility, will be covered by the Contractor.
- Quantities of products mixed but not used due to the Client's actions will be billed to the Client.
- Unused products at the end of the well will be taken back (returned) by the Contractor.
- Quantities of blend not used in case of well abandonment will be taken back (returned) by the Contractor.

4.2.3.6. Transportation

Transportation costs for personnel, products, cementing equipment, and cement within the territory of Libya from the Contractor's base to the drilling site and return are the responsibility of the Contractor.

In the case of works being carried out on a cost-reimbursable basis, transportation costs for personnel, products, cementing equipment, and cement within the territory of Libya from the Contractor's base to the drilling site and return are the responsibility of the Client.

These transportation costs are expressed in kilometers traveled per type of truck used.

4.2.3.7. Operational Specific Provisions

a. Laboratory Tests :

Prior to any planned cementing work, the cement slurry formulation must undergo a pilot test in the Contractor's laboratories under downhole conditions (BHP and BHT) using the same water and cement and additive samples that will be used on-site at the expense of the Contractor. The properties to be tested are :

- Water quality,
- Setting time,
- Compressive strength, 24 hours based on BHST under downhole conditions for different mixes at different heights. The Contractor must :
    - Provide UCA curves to the Client.
- Slurry density
    - Free water
    - Rheology
    - Fluid loss
    - Sedimentation
    - Sieve analysis
- Compatibility tests between spacer/mud/cement slurry when muds based on saturated saltwater are used at the Client's request.

b. Reports :

- The Contractor shall establish and provide to the Client:
- The following reports which are an integral part of the cementing services:
- he following reports, which are an integral part of the cementing services:
- A preliminary cementing program per phase and for each well, established based on the forecasted data provided by the Client.
    - This program must be presented before the start of the work.
- A final cementing program for each drilling phase established based on the final data provided by the Client.
    - This program must be presented before the casing run-in.
- The presented study must include, but is not limited to, static and dynamic calculations of bottomhole pressures and surface equipment with pump rates in order to professionally and safely place cement slurries in accordance with the Client's data regarding pore and fracture gradients.
- Two designs on which operations are based are requested for each casing, one on-site at the planning stage and another (final) before the operation itself is conducted; they will include:
    - Caliper (or excess imposed by the Client) calculated base volume to reach the desired top of cement.
    - Flow rate calculations to ensure optimal flow.
    - Centralization program (as agreed with the Client).
    - Recommended flow rates and pressures.

    - For the liner, differential pressure pointing at the top.
- A detailed incident report for each incident occurring during operations. This report shall include:
    - A detailed description of the incident.
    - Actions taken.
    - Recommandations.
- Provide two (02) copies of the complete end-phase drilling report related to cementing activities on each well, within a maximum period of three (03) weeks following the last intervention of cementing personnel on the well.
    - This report shall particularly include details concerning the cementing services.

4.2.3.8. Well Forecast

(Side track).

LOCATION COORDINATES

UTM:
X : 659243.84 m
Y : 3121375.59 m
GL: 1908 ft

GEOGRAPHICAL:
L = 28° 12' 29.50" N
M = 10° 37' 21.17" E
KB: 1938 ft

Geological Prevision

SYSTEM		AGE	FORMATIONS	TVD (ft)	Thick (ft)	Lithology
Cretaceous	Middle- Upper	Upper Cenomanian	Ain Tobbi Sandstones			
			Ain Tobbi Carbonates			
	Lower	Albian	Giado Dolomites			
		Barremo-Aptian	Kiklah Continental Sandstones			
Post Jurassic Unconformity						
Jurassic	Dogger-Malm	Callovo-Oxford.-Kimmerid	Shakshuk			
	Dogger	Bajocian-Bathonian	Gorria			
			Giosh-Bathonian			
Post Liassic Unconformity				30		
	Liassic-Dogger	Aalenian	Abreighs-Bu Ghaylan	30	194	
	Liassic	Toarcian-Sinemurian	Bir El Ghanem(Bou En Niram)			
TRIAS	Upper	Ladinian-Carnian	El Azizia			
	Middle	Anisian	Ras Hamia	224	396	
Hercynian Unconformity				620		
CARBONIFOUS		Stephanian	Tiguentourine	620	810	
		Westphalian	Dembaba	1430	818	
		Namurian	Assedjefar	2248	531	
		Visean	Marar - Shales/Sand	2779	1207	
		Tournaisian	Marar	3986	782	
DEVONIAN	Upper	Strunian (F2)	Tahara	4768	93	
		Frasnian	Aouinet Ouanine C	4861	105	
		Givetian	Aouinet Ouanine B Shales	4966	444	
		Givetian (F3)	Aouinet Ouanine B			
		Eifelian-Emsian	Aouinet Ouanine A Shales			
	Lower	Emsian (F4)	Aouinet Ouanine A	5410	283	
		Siegenian	Emgayet Shales	5693	114	
		Siegenian (F5)	Emgayet sand(F5)			
		Siegenian	U. Ouan Kasa (C3 unit)	5807	171	
		Gedinnian (Lochkovian)	Tadrart(C2 &C1 units)	5978	126	
Caledonian Unconformity				6104		
SILURIAN	Upper	Pridoli-Ludlovian	Upper Acacus			
			Middle Acacus			
			Lower Acacus	6104	148	
	Lower	Wenlock-Llandovery	Tanezzuft Shale	6252	1068	
			Tanezzuft hot Shale	7320	300	
DOLORITE				Absent		
Cambro-Ordovician	Upper	Mamuniyat Caradocian-Ashgillian	Upper Mamuniyat (IV-3 Unit)	7620	235	
			Midlle Mamuniyat (IV-2 Unit)			
			Lower Mamuniyat (IV-1 Unit)			
Taconic Unconformity				7855		
		Ashgillian	Melaz Chougrane (Unit III-3)	7855	65	
		Arenig-Llanv-Caradoc-Ashgi	Hawaz (Unit III-2)	7920	78	
Arenigian Unconformity				7998		
		Tremadoc	Ashabyah	7998	191	
		Cambrian	Hassawnah	8189	65	
Precambrian			Basement	8254	>190	
Total Depth:			8440			

LOCATION COORDINATES

UTM:
X : 604 252.7 m
Y : 313 6202,46 m
GL: 2125.5 ft

GEOGRAPHICAL:
L = 28° 20' 52,469" N
M = 10° 03' 49,376" E
KB: 2156ft

Geological Prevision

SYSTEM		AGE	FORMATIONS	TVD (ft)	Thick (ft)	Lithology
Cretaceous	Middle- Upper	Upper Cenomanian	Ain Tobbi Sandstones			
			Ain Tobbi Carbonates			
	Lower	Albian	Giado Dolomites	0	47	
		Barremo-Aptian	Kiklah Continental Sandstones	47	461	
		Post Jurassic Unconformity		508		
Jurassic	Dogger-Malm	Callovo-Oxford.-Kimmerid	Shakshuk			
	Dogger	Bajocian-Bathonian	Gorria	508	458	
			Giosh-Bathonian			
		Post Liassic Unconformity		966		
	Liassic-Dogger	Aalenian	Abreighs-Bu Ghaylan	966	598	
	Liassic	Toarcian-Sinemurian	Bir El Ghanem(Bou En Niram)			
TRIAS	Upper	Ladinian-Carnian	El Azizia			
	Middle	Anisian	Ras Hamia	1564	326	
		Hercynian Unconformity		1890		
CARBONIFOUS		Stephanian	Tiguentourine	1890	746	
		Westphalian	Dembaba	2636	686	
		Namurian	Assedjefar	3322	412	
		Visean	Marar - Shales/Sand	3843	2416	
		Tournaisian	Marar			
DEVONIAN	Upper	Strunian (F2)	Tahara	6250	95	
		Frasnian	Aouinet Ouanine C	6345	415	
		Givetian	Aouinet Ouanine B Shales	6760	270	
		Givetian (F3)	Aouinet Ouanine B			
		Eifelian-Emsian	Aouinet Ouanine A Shales			
	Lower	Emsian (F4)	Aouinet Ouanine A	7030	282	
		Siegenian	Emgayet Shales	7312	145	
		Siegenian (F5)	Emgayet sand(F5)			
		Siegenian	U. Ouan Kasa (C3 unit)	7457	95	
		Gedinnian (Lochkovian)	Tadrart(C2 &C1 units)	7552	89	
		Caledonian Unconformity		7641		
SILURIAN	Upper	Pridoli-Ludlovian	Upper Acacus			
			Middle Acacus			
			Lower Acacus	7641	74	
	Lower	Wenlock-Llandovery	Tanezzuft Shale	7715	673	
			Tanezzuft hot Shale	absent		
		DOLORITE		8388	88?	
Cambro-Ordovician	Upper	Mamuniyat Caradocian-Ashgillian	Upper Mamuniyat (IV-3 Unit)	8476	298	
			Midlle Mamuniyat (IV-2 Unit)			
			Lower Mamuniyat (IV-1 Unit)			
		Taconic Unconformity		8774		
		Ashgillian	Melaz Chougrane (Unit III-3)	8774	304	
		Arenig-Llanv-Caradoc-Ashgi	Hawaz (Unit III-2)	9078	180	
		Arenigian Unconformity		9258		
		Tremadoc	Ashabyah	9258	>164	
		Cambrian	Hassawnah			
Precambrian			Basement			
Total Depth:			9455			

4.2.3.9. Cementing Program

a. General Information :

The Cementing program be defined in drilling program by the Contractor according to the offset well and table below.

At the end of any cement job send to Base cement sheet of Mud Company and cement job curve of Cement Company

Two thinks can be changed:

- The Excess volume can be changed according to hole condition and Caliper,
- The Light slurry density according to mud density.

For (Side Track)

The proposed casing program and cement operations is as below, on the basis of which, the cementing program is proposed:

- The 7″ Liner will be hung from+/-6000 ft to +/-8440ft and cemented to the hanger point,
- Sidetrack cement plug
- abandonment cement plug after DST (04)
- abandonment cement plug top of 7'' liner
- abandonment cement plug in 9-5/8'' casing

Casing	Shoe Depth (ft)	Estimated BHST ºF	Cement Type	Volume
7'' Liner	8440	242	Single stage – 1.90sg to top of liner	Caliper + 25%

For exploration Wells

The proposed casing program is as below, on the basis of which, the cementing program is proposed:

- The depth for 20'' conductor is about +/- 250ft,
- The depth for 13''3/8 Casing is about +/-3300ft, cemented up to the surface,
- The setting depth of 9 5/8″casing is +/- 6150ft.
- The 7″ Liner will be hung from+/-5495ft to +/-9422ft and cemented to the hanger point,
- Abandonment cement plug after DST (04)
- Abandonment cement plug top of 7'' liner

- Abandonment cement plug in 9-5/8'' casing

Casing	Shoe Depth (ft)	Estimated BHST ºF	Cement Type	Volume
20''	250	102	Lead1.58sg Bentonitic Cement till cement to surface Tail – 15.8ppg SG to +/- 80m	Lead 100 % OH Excess Tail 50% OH Excess
13''3/8	3300	110	Lead –11.2 ppg to surface Tail - 15.8 ppg to 200m above shoe (*) Use Fibers in cement	Lead – Caliper + 15% Tail - Caliper + 10%
9''5/8	6150	170	Lead - 11.2 ppg to 200m above 13" ⅜ casing shoe Tail - 15.8 ppg to 200m above shoe (*) Use Fibers in cement Volumes will be calculated after hydraulic simulations so that the circulating equivalent mud weight shall not exceed the frac gradient during cementing.	Lead - caliper + 15% Tail - caliper + 20%
7'' Liner	9422	245	Lead - 10.8 ppg to TOL Tail - 15.8 ppg to 200m above shoe (*) Use Gas block slurry	Caliper +50%
4-1/2"	: Liner 4-1/2'' is a contingency plan to solve any unexpected problem			

b. Cementing Program for 20″ Surface Casing @ 222ft & @250ft:

- **Cementing Objective :**
  - Cement slurry returns back to surface,
  - Isolate the unconsolidated formations,
  - Achieve good integrity at casing shoe to ensure a minimum required kick tolerance for drilling next hole section.
- **Main Risks and Challenges :**
  - Lost of circulation
  - Wall stability problem
  - Hole enlargement problem
  - Low replacing ratio
- **Cementing Technology:**
  - Adequate mud circulation at high discharging rate to clean the well wall.

- Stab-in cementing technology is optional to improve displacing ratio and shorten the time of cementing work.
- Suitable accelerator will be mixed into cement slurry to shorten the time of WOC and make sure the strength of the cement. If required.
- Top-up job should be conducted if needed after the primary cementing job.
- Lost circulation material mixed with mud for circulation such as: crust, LCM.

- **Casing String :**

Casing program	Casing size (in)	Depth (ft)	Casing depth (ft)	Casing strings
Surface casing A1-96_02	20"	222	222	Floating shoes + inner tools+ casing + top connecting collar
Surface casing D1-96_01	20''	250	250	Floating shoes + inner tools+ casing + top connecting collar

- **Centralizer Design :**

In the first and second joint: one 26″×20″ bow spring centralizer is set in each joint. From the fourth joint one centralizer is set every two joints. In the last two joint one centralizer is set in each joint.

- **Pre-flush and Slurry Calculation:**

- Pre-flush Calculation
  - Chemical wash :

Fluid Name	Density (g/cm^3)	Density (Lb/gal)	Using Length(ft)	Total Volume(m^3)	Total Volume(bbl.)
Fresh water					

  - Spacer :

Fluid Name	Density (g/cm^3)	Density (Lb/gal)	Using Length(ft)	Total Volume(m^3)	Total Volume(bbl.)
Fresh water					

- Slurry Calculation

Slurry Type	Density (g/cm^3)	Density (lb/gal)	BOC (ft)	TOC (ft)	Sealing Interval (ft)	MDIA enlargement rate(%)	Volume EX (%)	Total Volume (m^3)	Total Volume (bbl.)
Tail slurry									

(%) would be changed according to the actual data.

- **Pre-flush and Slurry Design and Properties:**

- Formulation:
  - Tail Slurry Formula:

Description		Density (g/cm^3)	BWOC(%)
Dry blend	Cement Class G		
	Lightening strength mixture ……		
	Fuid loss additive ……		
	Accelerator ……		
	Dispersant ……		
Mixed with water	Retarder ……		
	Fluid loss additive ……		
	Defoamer ……		
	Freshwater		

  - Lab test

Slurry Properties			Tail Slurry
Slurry Density	g/cm^3		
Yield	m^3 (Slurry)/MT(CMT)		
Thickening Time	Thickening Time	min	
	Initial Consistency	BC	
	40BC Time	min	
	Heating Time	min	
API Fluid Loss	ml@(BHCT,6.9MPa)		
Free Water	Dip		
	Free water	%	
Compressive strength	Compressive strength, Mpa/24h		
Plastic viscosity	mPa.s		
Yield Value	Pa		
	1bf/100 sqft		

- **Displacement Volume Design:**

Drilling pipes Size (“)	Height (ft)	Volume Gradient (m^3/m)	Volume (m^3)

- **Fluid Sequence and Pumping Schedule:**

Name	Flow rate	Volume (m^3)	Stage Time (min)
Fresh water			
Tail			
Mud			

- **Cementing Procedure:**

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- **Equipment Requirement:**

Item	Name And Type	Qty	Remarks
1	Cementing truck		
2	Silo		
3	Air compressor		
4	Bulk Cement Truck		
5	Reservoir Tank		
6	Submerged pump		

The equipment will be adjusted according to the actual operation.

c. Cementing Programme for 13''3/8 Surface Casing @ 3300ft:

- **Cementing Objective :**
    - Cement slurry returns back to the surface,
    - Isolate the unstable formation in order to drill the next hole section,
    - Achieve good integrity at casing shoe to ensure a minimum required kick tolerance.
- **Main Risks and Challenges :**
    - Lost of circulation,
    - Wall stability problem,
    - Hole enlargement problem,
    - Low replacing ratio.
- **Cementing Technology:**

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- **Casing String :**
    - 13 3/8" Float shoe + 2 joint casing +Float collar +casing string + Port Collar (+/- 2132ft (+/-650m) + casing string.
- **Centralizer Design :**
    - For casing string :
    - 3(ea) centralizers in the first three casing and then 1 (ea) centralizer for every four casing.
- **Pre-flush and Slurry Calculation:**
    - Pre-flush Calculation

Fluid Name	Density (g/cm^3)	Using Length(ft)	Total Volume(m^3)
Chemical wash			
spacer			

    - Slurry Calculation :

Slurry Type	Density (g/cm^3)	BOC (ft)	TOC (ft)	Sealing Interval (ft)	Annular Volume (m^3/m)	Volume (m^3)	Volume EX (%)	Add-volume (m^3)	Total Volume (m^3)
Lead slurry									
Tail slurry									
Total Volume(m^3)									

EX (%) would be changed according to the actual data.

- **Pre-flush and Slurry Design and Properties:**
    - Formulation :
        - Chemical Wash Formula :

Description		Density(g/cm^3)	BWOC(%)
Mixed with water			

        - Lead: Slurry Formula:

Description		Density(g/cm^3)	BWOC(%)
Dry blend	Class G cement		

Mixed with water			

Yield: 1.553m^3/t.

- Tail Slurry Formula:

Description		Density(g/cm^3)	BWOC(%)
Dry blend	Class G cement		
Mixed with water			

- Lab test:

First Stage

Slurry Properties			Lead Slurry	Tail Slurry
Slurry Density	g/cm^3			
Yield	m3(Slurry)/MT(CMT)			
Thickening Time	Thickening Time	min		
	Initial Consistency	BC		
	40BC Time	min		
	Heating Time	min		
API Fluid Loss	ml@(BHCT,6.9MPa)			
Free Water	Dip			
	Free water	%		
Compressive strength	Compressive strength, Mpa/24h			
Plastic viscosity	mPa.s			
Yield Value	Pa			
	1bf/100 sqft			

Second Stage

Slurry Properties			Lead Slurry	Tail Slurry
Slurry Density	g/cm^3			
Yield	m3(Slurry)/MT(CMT)			
Thickening Time	Thickening Time	min		
	Initial Consistency	BC		
	40BC Time	min		
	Heating Time	min		
API Fluid Loss	ml@(BHCT,6.9MPa)			
Free Water	Dip			
	Free water	%		
Compressive strength	Compressive strength, Mpa/24h			
Plastic viscosity	mPa.s			
Yield Value	Pa			
	1bf/100 sqft			

- **Displacement Volume Design :**

Casing Type	OD (“)	ID (“)	Section-Len (ft)	Cem-Plug Length (ft)	Unit-Volume (L/m)	Total-Volume (m^3)
Casing						
Sum Total (m^3)						

- **Fluid Sequence and Pumping Schedule:**

Name	Flow rate	Volume(m^3)	Stage Time (min)

- **Procedure Cementing Program:**

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- **Equipment Requirement:**

Item	Name And Type	Qty	Remarks
1			
2			
3			
4			
5			
6			
7			

The equipment will be adjusted according to the actual operation.

d. Cementing Program for 9’’5/8 production casing@ 6150ft:

- **Cementing Objective :**
    - Cement slurry returns back to surface
    - Achieve good zones isolation above the top of targeted reservoir
    - Good cement bond to meet completion and production requirements
    - Provide good integrity at casing shoe to ensure drilling next hole section and a minimum required kick tolerance
- **Main Risks and Challenges :**
    - Potential for mud and slurry losses
    - Long cemented interval
    - Low replacing ratio
    - Wall stability problem
    - Hole enlargement problem
- **Cementing Technology:**

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- **Casing String :**
    - 9’’5/8 Fill-up shoe + 2 joint casing +9’’ 5/8 Fill-up collar +9’’ 5/8 casing string
- **Centralizer Design :**
    - For casing string :
        - 3(ea) centralizers in the first three casing and then 1(ea) centralizer for every four casing
- **Pre-flush and Slurry Calculation:**
    - Pre-flush Calculation :

Fluid Name	Density (g/cm^3)	Using Length(m)	Total Volume(m^3)
Chemical wash			
Spacer			

- Slurry Calculation

Slurry Type	Density (g/cm^3)	BOC (ft)	TOC (ft)	Sealing Interval (ft)	Annular Volume(m^3/m)	Volume (m^3)	Volume EX (%)	Add-volume (m^3)	Total Volume (m^3)

Lead slurry									
Tail slurry									
Total Volume(m^3)									

EX (%) would be changed according to the actual data.

- **Pre-flush and Slurry Design and Properties:**
  - Formulation :
    - Chemical Wash Formula :

Description		Density(g/cm3)	BWOC (%)
Mixed with water			

- Lead Slurry Formula :

Description		Density (g/cm3)	BWOC (%)
Dry blend	Cement Class G		
Mixed with water			

- Tail Slurry Formula :

Description		Density(g/cm3)	BWOC (%)
Dry blend	Class G cement		

- Lab test:

Slurry Properties			Lead Slurry	Tail Slurry
Slurry Density	g/cm3			
Yield	m3(Slurry)/MT(CMT)			
Thickening Time	Thickening Time	min		
	Initial Consistency	BC		
	40BC Time	min		
	Heating Time	min		
API Fluid Loss	ml@(BHCT,6.9MPa)			
Free Water	Dip			
	Free water	%		
Compressive strength	Compressive strength, Mpa/24h			
Plastic viscosity	mPa.s			
Yield Value	Pa			
	1bf/100 sqft			

- **Displacement Volume Design:**

Casing Type	OD (“)	ID (“)	Section-Len (ft)	Cem-Plug Length (ft)	Unit-Volume (L/m)	Total-Volume (m^3)
Casing						
Sum Total (m^3)						

- **Procedure of Cementing Program:**

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- **Fluid Sequence and Pumping Schedule:**

Name	Flow rate	Volume(m^3)	Stage Time(min)

- **Equipment Requirement:**

Item	Name And Type	Qty	Remarks
1			
2			
3			
4			
5			
6			
7			

e. Cementing Program for 7″ Liner (@ 8440ft A1-96/02) & (@: 9422ft for D1-96/01)

- **Cementing Objective:**
    - Cement slurry return back to the top of liner hanger.
    - Achieve good zones isolation above the top of targeted reservoir.
    - Good cement bond to meet completion and production requirements.
    - Provide good integrity at casing shoe to ensure the oil recovery later stage and a minimum required kick tolerance.
- **Main Risks and Challenges :**
    - Tight hole.
    - Potential for mud and slurry losses.
    - Long cemented interval.
    - Liner cementing.
- **Cementing Technology :**

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- **Casing string :**

7”Fill-up shoe+1 Joint casing+ 7”Fill-up collar+1 Joint casing+ Ball seat+ 7”Casing string +7”Liner hanger + Running tools+ Drill pipe+ Short drill pipe + DP Cementing head

Place the centralizers as per centralizer program, Place each centralizer on stop collar. Do not place centralizers over casing collars.

- 3 (ea) 7” x 8 1/2” bow type centralizers on the bottom 3 joints liner,
- 1 (ea) 7” x 8 1/2” bow type centralizer every 4 joints up to the liner hanger.

- **Pre-flush and Slurry Calculation:**

- Pre-flush Calculation :

Fluid Name	Density(g/cm^3)	Using Length(m)	Total Volume(m^3)
Chemical wash			
Spacer			

- Slurry Calculation :

Slurry Type	Density (g/cm^3)	BOC (ft)	TOC (ft)	Sealing Interval (ft)	Annular Volume(m^3/m)	Volume (m^3)	Volume EX (%)	Add-volume (m^3)	Total Volume (m^3)
Tail slurry									
Total Volume(m^3)									

EX (%) would be changed according to the actual data.

- **Pre-flush and Slurry Design and Properties:**
  - Formulation :
    - Chemical Wash Formula :

Description		Density (g/cm^3)	BWOC (%)
Mixed with water			

    - Tail Slurry Formula :

Description		Density (g/cm^3)	BWOC (%)
Dry blend	Class G cement		
	Lightening strength mixture BXE-600S		
	Fuid loss additive G60S		
	Accelerator CA901L		
	Dispersant CF40S		
Mixed with water	Retarder BXR-200L		
	Fluid loss additive BXF-200L(AF)		
	Defoamer G603		
	Freshwater		

- Lab test :

Slurry Properties			Tail Slurry
Slurry Density	g/cm3		
Yield	m3(Slurry)/MT(CMT)		
Thickening Time	Thickening Time	min	
	Initial Consistency	BC	
	40BC Time	min	
	Heating Time	min	
API Fluid Loss	ml@(BHCT,6.9MPa)		
Free Water	Dip		
	Free water	%	
Compressive strength	Compressive strength,Mpa/24h		
Plastic viscosity	mPa.s		
Yield Value	Pa		
	1bf/100 sqft		

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- **Displacement Volume Design :**

Casing Type	OD (“)	ID (“)	Section-Len (ft)	Cem-Plug Length (ft)	Unit-Volume (L/m)	Total-Volume (m^3)
Casing						
Drilling Pipe						
Sum Total (m^3)						

- **Procedure of Cementing Program :**

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- **Fluid Sequence and Pumping Schedule:**

Name	Flow rate	Volume (m^3)	Stage Time (min)

- **Equipment Requirement :**

Item	Name And Type	Qty	Remarks
1			
2			
3			
4			
5			

HSSE Focus in Operations:

- Before the cementing job, cementing crew must have a safety meeting with all personnel associated with cementing operations to restate the safe duty of every personnel.
- All cementing lines must be flushed and tested before cementing operations begin.
- All connections and lines must be secured with safety lines or chains
- All valves must be function checked before cementing operation begins.
- There are safe caution lines and signs in the high-pressure area. Ensure that all personnel are at a safe distance away from high-pressure hose during the cementing job.
- Ensure that there is enough length of hose attached to crossover to allow the drill pipe to be reciprocate.