

BPXC Stuck Pipe Guidelines

S. P. O. T.

Stuck Pipe Observation Team



BPX Colombia

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1. COMMUNICATION

All key rig crew will require valid ***stuck pipe certificates*** prior to working on BP rigs. Certificates will be valid for 2 years and will be obtained following successful completion of a recognised stuck pipe course.

Stuck Pipe awareness sessions should be held prior to drilling lower Carbonera on all wells. Formal presentation and Discussion involving BP DS, DE, Company Man, Toolpushers, Drillers, Mud Eng. & Mud Loggers. Recent incidents and offset data to be explained

Avoid same time for ***crew change*** of Drillers, Tool Pushers and Mudloggers. Recommend 6 hour stagger.

The mudloggers should ***call the drillfloor*** before making a connection to check that everything is OK

Tripping procedures must be installed on rig floor, Mud logging unit, Mud Engineer office, toolpusher office and Company Man office in English and Spanish

While drilling or reaming in the Carbonera formation, have ***2 men at the console***, 1 on the brake and the other on the pumps. Consider this for other problem formations such as Los Cuervos.

2. JOB PLANNING

Why 'What if' the job?

It is better to prevent a disaster from occurring than try to stop it at the early stages - if you can stop it at all.

Equipment

- ☐ Is it the right equipment for the job?
- ☐ Is the equipment properly rated, inspected and tested?
- ☐ Can it be rigged up safely?

Procedures

- ☐ It is safe?
- ☐ Does it need to be changed?
- ☐ Does everyone understand their job?

Remember to 'What if' the job

What is the worst thing that could happen to us during the job?

- ☐ Impact on Personal safety?
- ☐ Impact on the Environment?
- ☐ Impact on well control?
- ☐ Impact on equipment?

What else might happen?

- ☐ How do we prevent the above 'What if' s from occurring?
Are we prepared?
- ☐ Do all the crew understand the operation and know how to react to the 'What if' if it occurred?
- ☐ What extra precautions do we need to take if we have a new company, crew, person to ensure they understand know what to do

3. DATA COLLECTION

Always plan the trip. Use a pre-trip checklist .

Monitor shaker at all times. Measure time to fill 5 gallon bucket every hour. Inform Co Man and rig floor of any changes in rates

The drilling parameters should be ***recorded every 15 minutes*** using the Driller Handover notes form. Any changes in trends should be acted upon. The driller should be responsible for noting the parameters and recording them . Use consistent parameters as trends are easier to spot.

Monitor the difference between the measured cuttings/***cavings rates*** and theoretical hole volume cut. Negative values or zero could mean that there is inadequate hole cleaning.

There should always be appropriate and ***good quality information on the rig floor***

- ☐ Good Handover notes are essential
- ☐ A mud log of the open hole section should be on display in the dog house
- ☐ A clear pipe tally should be available so depths can easily be equated to stand numbers.
- ☐ A good record of problem areas (ledges, tight spots etc) from the past trip is important. Visual guides are best: either mark the mud log or use mud loggers real time plots

4. DRILLING

Around the Yopal fault *minimise stabilisers* and use spiral blades if necessary. Use spiral DCs.

No drill string float will be run below the 13 3/8" shoe -

Mud should be *as programme*. Check with DEAP to see if maximum values required.

The *Mud weight will be raised* continuously throughout the Carbonera as per the mud weight schedule if losses allow

Around faults or coals *wiping* may be required.

Indication of *change in parameters* should be addressed and the Co. Man informed. Increase in torque/drag/ pressure may indicate loading of annulus and formation of pack-off. Circulate and clean up the wellbore before continuing drilling.

When taking Surveys also come *high enough off bottom* (10 ft) to be able to work the pipe down if required

5. CONNECTIONS

Wipe at least the last stand prior to making a connection - if erratic or high torque is experienced prior to the connection, some time and effort should be taken to clean the hole

Have a ***single in the V door*** in case downward motion is required to free the pipe after a connection

Mud loggers should ***calculate transport ratio*** and slip velocity to ensure that cuttings will not fall back during the normal connection time.

After drilling or reaming, cuttings should be ***circulated at least above the BHA*** prior to making the connection.

Always set the slips so the tooljoint is high enough to ***allow downward movement***. If hole conditions are sticky extra stick up may be required. Take care not to bend the pipe if pipe is set high.

Make sure the ***pipe is free before setting the slips***
Connections should only be made if hole condition is good.
Take time to wipe hole and circ prior to setting slips

At Kelly Down (Top Drive) always ***allow the WOB to drill off*** prior to picking up off bottom especially when drilling with high WOB

Minimise the period without circulation during a connection.
Always ***confirm circulation*** after a connection prior to moving the pipe

If differential sticking is suspected to be a risk, ***maximise pipe motion***, consider rotation of string with slips set whilst picking up the next stand.

Avoid starting and stopping the pumps suddenly, this may disturb the wellbore downhole (shock loading effect). Start pumps at half speed and ensure pressures are stable before increasing pump rate further.

Always begin ***pipe motion downwards*** once slips are pulled.

When using 5 1/2" and 6 5/8" drillpipe, with the Varco TDS 3 top drive, the pipe will need to be ***re-torqued after the connection*** has been lowered for the back-up system to tong level. This operation should be treated as a connection and the above guidelines followed

6. TRIPPING

Always plan the trip. Have an up to date mudlog on the rig floor. Know where high doglegs exist and note troublesome areas from past trips. The new mudlog tripping plot should be available on the rig floor. A good understanding of this plot will assist in safer and quicker trips

Ensure that the rig floor personnel ***know what overpull to use***, prior to picking up the top drive and pumping or rotating out of the hole. This will vary depending on hole condition and trends however be conservative.

Keep a ***written record of stand nos.*** and depths and magnitude of overpulls, reamed sections etc. Ensure an up to date copy of this information is always available on the rig floor.

Company man to ***discuss tripping procedures*** with rig crew and to be on the rig floor during critical parts of all trips..

Always Circulate the ***hole clean prior to tripping***, ensure the shakers are clean. Consider calculated hole cleaning time.

When circulating the hole clean prior to trip out: ***record*** the following ***parameters*** : Pick up weight, slack off weight, rotating weight, and pump pressure at normal and reduced flow rates. When top drive is removed and pulling - note pick up/slack off weights without circulation.

If drilling parameters not steady, slack off to rotating weight. Work torque into string to rotate (should avoid pack-off). Have single in V door ready to pick up

Ensure ***digital pressure gauge*** is working.

Always maintain circulation on connections for as long as possible. Always maximise pipe motion in open hole. ***Connections should only be made if hole condition is good.*** Take time to wipe hole and circ prior to setting slips.

Always set the slips so the tooljoint is high enough to ***allow downward movement.*** If hole conditions are sticky extra stick up may be required. Take care not to bend the pipe if pipe is set high.

When pulling out of hole pipe ***motion should always be down prior to up.*** Increase pull to up weight, then slowly pull until stand pulled to 10ft. Note pressures while picking up. Continue to pull. If pressures not as expected, pick up no further. Slack off if possible.

While tripping always ***try to pull without the pumps*** and rotation. If necessary kick in the pumps (slowly) and finally rotate if no progress is being made.

When POOH through coal beds/fault zones the bit will be ***pulled dry*** up to a maximum of 75Klbs (in 25 Klb stages). Then the bit will be washed or reamed back through the coal/fault. Do not jerk the pipe -use a steady pull

When breaking circulation pull the slips but stay below up rate. Bring up pumps to half drilling flow rate + ***confirm returns and stable pressure.*** Ensure pressures correspond to data previously collected After 1 minute stable pressure increase pump rate. Again ensure pressures remain stable for 1 min

Be prepared to stop the trip and circulate and if necessary, ream. Whenever the pumps are on, monitor the shakers for cave-in rate trends

Do not pump a slug until you are sure the hole is free and the pipe no longer requires to be pumped out. However, if hole conditions are bad after the slug has been pumped do not hesitate to pump out.

When RIH, the bit will always be ***washed through fault zone & coal beds.***

Always wash at least the ***last stand*** to bottom after a trip.

Check top drive ***saver sub*** on a regular basis to ensure threads are in good condition.

Never let the slips ride the pipe. Stop the pipe and lower pipe slowly onto the slips to avoid pipe damage.

7. WASHING AND REAMING

Reaming contributes to increased hole deterioration. In addition reaming and back reaming account for over 60% of BPXC stuck pipe incidents. Reaming the hole has the greatest risk of sticking associated with it due to the fact that the BHA continues past "stirred up" cuttings beds and can therefore pack-off. The preferred practice is to always try to work the string past a tight spot as a first option, however overpull limits must be known and used. Work up to the overpull limit in stages ensuring free movement in the other direction at each stage. Understanding the geology and hole condition is important, different actions may be required if different formations eg: undergauge sand, ledges etc Ensure the driller knows what actions to take in the event of problems. Prepare written instructions for the driller.

Do not use the soft torque while reaming as it may disguise torque trends.

Increase in drag, torque or pressure may indicate that the annulus is loaded up and a pack-off may be forming. Take time to clear up the hole. Know and follow the freeing procedure for pack-off should packing off occur.

While reaming in the Carbonera formations around faults or coals ***pick up and wipe the hole*** on a regular basis..

The shakers must be ***monitored continuously*** and the volume of solids being removed from the wellbore should be recorded. Reaming speed and circulation time should be adjusted if volume rate dictates

Coal has been the cause of several stuck pipe incidents, ***know where the coal seams exist*** and be prepared to ream them on first few passes

Reaming operations should be conducted as smoothly as possible, ***rotation speed*** should be dictated by ***torque and pressure***, and kept as low as possible.

Consistent parameters should be used for reaming operations to assist in the identification in changes of torque and pressure trends.

Reaming operations should be conducted at the ***same flow rate as drilling***.

Reaming parameters should be ***recorded every 15 minutes*** and any changes in trends should be acted upon. The driller is responsible for noting the parameters and recording them on the standard form. Mud loggers to inform driller immediately of any changes in trends

Indication of change in parameters should be addressed.. ***Increase in torque/drag/pressure*** may indicate loading of annulus and formation of pack-off. Circulate and clean up the wellbore before continuing reaming.

Have ***single in the V-door*** in case downward motion is required to free pipe after a connection.

Have a ***contingency plan*** for possible problems - eg Leaking swivel packing or saver sub.

After drilling or reaming cuttings should be ***circulated above the BHA*** prior to picking up to make a connection. Rig floor

personnel must know the time required to circulate the BHA clear.

Make sure the pipe is *free before setting the slips*. When backreaming OOH do not pull the pipe up into the slips to connect the top drive. Use a working single, or work back the previous stand to allow a high disconnection to be made

If pump pressures take a *long time to fall to zero* after stopping the pumps the annulus may be loaded with solids. Take time to circulate the hole clean.

Prior to reaming, slow rotation or rocking pipe should be attempted to *"walk" the pipe* through ledges.

When washing in with a motor in the BHA *rotate the whole string at the lowest rate possible*. Ensure that the pressure to overcome friction and the motor stator/rotor friction is known so that adequate pump pressure is applied to the string when packed off. or the tendency to pack off occurs

If the *top drive stalls out* during reaming operations there is a great deal of stored energy in the torqued up drill string, always release this torque slowly.

Be alert to *washed out sections* directly below tight ledges. This often packs off until tripped through a few times

8. CASING RUNNING

A Wiper trip with a ***string reamer*** will be considered prior to running casing through the Carbonera.

Once reaming started, ***continue to ream*** on a clean-up trip.

9. REACTION TO PACK-OFF

If indications of pack-off occur, *immediately reduce the pump strokes to half*. If the hole does not pack-off, return to original parameters and be prepared to circulate the hole clean

If the hole does pack-off, *immediately shut off the pumps and slowly bleed off the pressure* under the pack-off down to 500 psi. The Choke on the stand pipe will always be used to bleed off pressure from Pack-offs. A controlled rate is used to avoid U tubing of solids into the drill string. (Higher pressures than 500 psi may be required for thick or heavy mud)

Cycle the drill string to a maximum stall out torque with pipe hanging at the free rotating weight. If progress is noted increase circulation (Take care not to burn out top drive motor.)

If no progress - *Work pipe between free up and free down weights*. Continue cycling the torque and maintain the 500 psi SPP below pack-off. Be prepared to work pipe with torque between up and down weights for up to 2 hours.

If no progress *slump the pipe* and continue to work torque.

If still no progress attempt to get movement by *jarring down* (Do NOT jar up)

Attempt to pull out by increasing *overpull* in 50klb steps up to 90% of maximum. Keep checking pipe is free down.

If still no progress - Slowly increase SPP to *1500 psi*. Continue working pipe and torque

10. REACTION TO DIFFERENTIAL STICKING

Work ***maximum torque*** down to the stuck point and hold torque in the string. Put maximum weight on string.

Circulate the hole at ***maximum flow rates*** to disturb the wall cake for at least hour.

Reduce flow rate and ***set down desired jar blow*** and allow jars to fire - Repeat

If string does not come free - ***repeat previous steps*** until a PRA pill is ready to spot

Use ***pill placement guidelines*** for recipe and procedures to pump pill.

Once pipe is free rotate the string and ***circulate the hole clean*** while conditioning the mud.

11. REACTION TO GEOMETRIC STICKING

Ensure that you have circulation. If the string became stuck while moving pipe up, ***apply torque and jar down.*** If the string became stuck while moving down, down not apply torque. ***Simply jar up.***

Jarring operations should ***start with light loading (50 Klb)*** and then systematically increase to maximum load over a one hour period. Stop or reduce circulation when cocking the jars and jarring down. Pump pressure will increase jar blow when jarring up

If jarring operations are unsuccessful. ***consider using acid pills*** if conditions permit. (A caustic pill will be required in coal.)

Use ***pill placement guidelines*** for recipe and procedures to pump pill.

Once free rotate the drill string and circulate the hole clean, condition and ***ream the problem area*** prior to pulling out of the hole.

12 FREE POINT INDICATION AND BACK-OFF

.Procedures from Aberdeen Manual

Guidelines for Drilling Operations Rev 5 (Oct 92)

A. STUCK PIPE MECHANISM IDENTIFICATION SHEET

PIPE MOTION PRIOR TO STICKING?	PACK-OFF/ BRIDGE	DIFFERENTIAL	WELLBORE GEOMETRY
Moving Up	2	0	2
Rotating Up	0	0	2
Moving Down	1	0	2
Rotating Down	0	0	2
Static	2	2	0
PIPE MOTION AFTER STICKING?			
Down Free	0	0	2
Down Restricted	1	0	2
Down Impossible	0	0	0
PIPE ROTATION AFTER STICKING?			
Rotate Free	0	0	2
Rotate Restricted	2	0	2
Rotate Impossible	0	0	0
CIRCULATING PRESSURE AFTER STICKING			
Circulation Free	0	2	2
Circulation Restricted	2	0	0
Circulation Impossible	2	0	0
TOTALS			

INSTRUCTIONS :

Answer the shaded questions by circling all the numbers in the row with the correct answer.

Add the columns, the column with the highest number indicates the sticking mechanism.

B. DIFFERENTIAL STICKING PILL FORMULATION

In the event that the drill string becomes differentially stuck, spotting fluid should be used (with the prior approval of DS/LDE) in an attempt to free the string. If possible the basic formulation for the ***SFT*** Pill should be premixed in diesel, before drilling any hole which has a greater angle than 20°. The rheology and density should be adjusted just prior to pumping. **The density of the *SFT* Pill should be heavier (0.5 ppg if possible) than the mud. MINIMUM STOCK OF *SFT*™ AT THE WELL SITE IS 400 sacks.**

SFT pill formulations(100 bbls):

DENSITY (ppg)	Diesel (bbl)	SFT (SX)	Water (bbl)	Barite (100lb/sx)
10.00	64	124	11	135
12.00	62	113	7	240
14.00	57	102	6	345

Note :

Prior to pumping, the rheology and stability of the pill must be checked. The aim is to produce a yield point of approximately **25**.

To ensure that the spotting fluid reaches the maximum possible area of the annulus it is recommended that a "shear thinning" spacer is pumped ahead of the spotting pill. This spacer should be designed so that the drilling fluid is displaced across the casing shoe.stuck zone just prior to the exposure to the ***SFT*** Pill. To ensure this the following properties are required:

Viscosity :100 rpm value of the pill must be greater than that of the circulating drilling fluid.

Density : ~0.5ppg (*see footnote 11*) greater than circulating drilling fluid density.

Formulation for 1 bbl

Fresh water 1.0

Xanthan Gum As required to meet the above Specification.

Barite As required to meet the above Specification.

The volume of spacer required will be determined by the annular section of the stuck point. The goal is to ensure the contact time of the spacer is optimised. Maximum pump rates must be used up to the point when the ***SFT*** Pill reaches the top of the stuck zone.

If the spacer is left static in the stuck area this will have the opposite effect and reduce the effectiveness of the ***SFT*** Pill.'

C. PILL PLACEMENT PROCEDURES.

Many pipe free pills are ineffective because they fail to contact the filter cake in which the pipe is stuck. This is because there is gelled mud in the narrow annulus of the stuck pipe area. Thus the **SFT** Pill takes the easy route up the wide annulus.

To increase the chances of placing the pipe free pill in the correct zone, the following procedures should be adopted.

1 A displacing spacer should be pumped ahead of the pipe free pill. In this instance, fresh water should be used.

2 As large a spacer as possible should be pumped and displaced at the maximum possible rate.

3 Increasing the density of the **SFT** Pill above that of the circulating mud weight will also act to drive out the gelled mud. The present recommendations are to increase the weight to 1.0 ppg above circulating mud weight.

4 The pipe free pill should be displaced to the stuck zone at the maximum possible rate.

5 To assure the drill pipe is clear while allowing the **SFT** Pill to soak, maintain enough of the pill in the drill pipe to pump 1/2 to 1 bbl per hour for the duration of the soaking period.

SFT Pill Contamination

Due to the potential for incompatibility between the drilling fluid and the diesel used in the SFT pill, before the pill is used and the pill is incorporated into the active system, the active fluid must be tested for any adverse reaction. If there is any doubt concerning the incorporation of any part of the SFT pill, every effort must be made to remove the pill at surface and prevent any contamination.

FULL DETAILS OF UP TO DATE PIPE RELEASE PILLS AND PLACEMENT PROCEDURES CAN BE FOUND IN THE DRILLING FLUIDS GUIDE BOOK, CHAPTER IV, SECTION 1.7

These can also be found on the WOPS server
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Program\The mud programme.doc

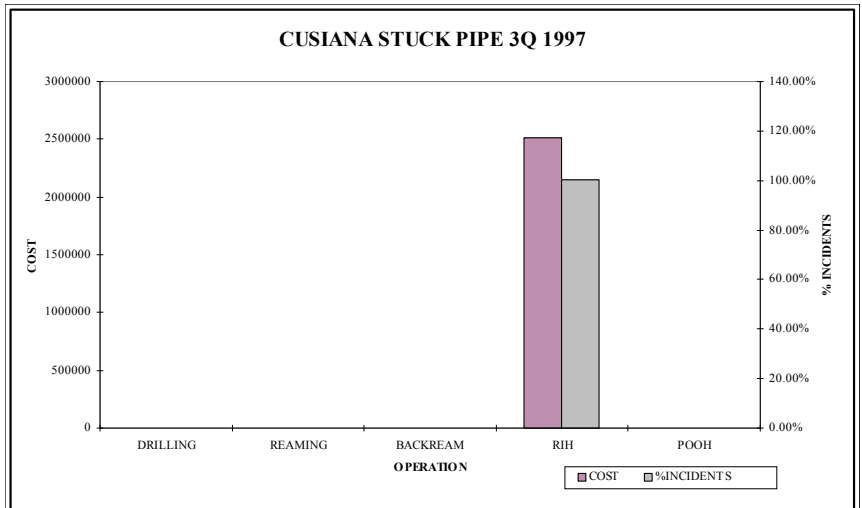
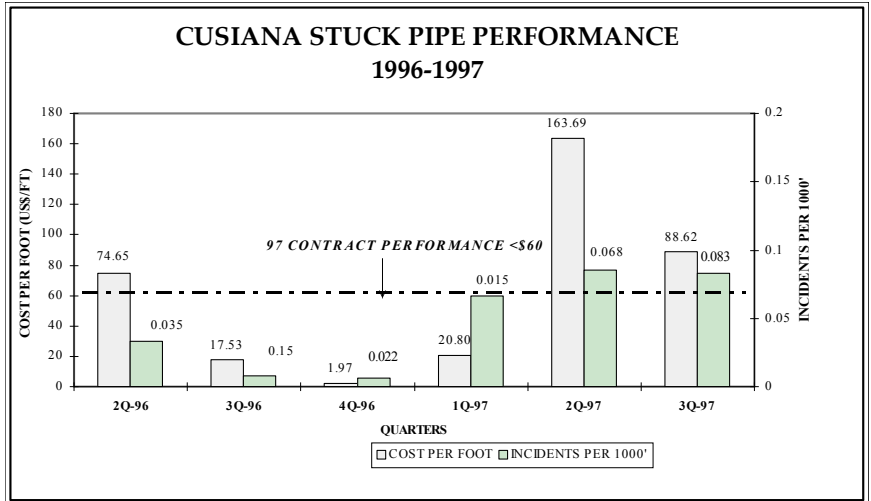
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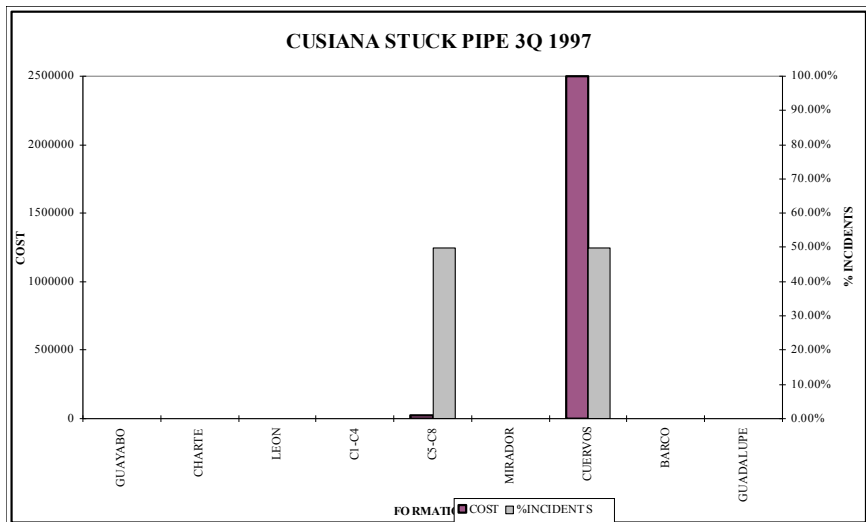
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under Basis of Design, Drilling Fluids BPXC, Drilling Fluids
Guidebook - Fluid Programme

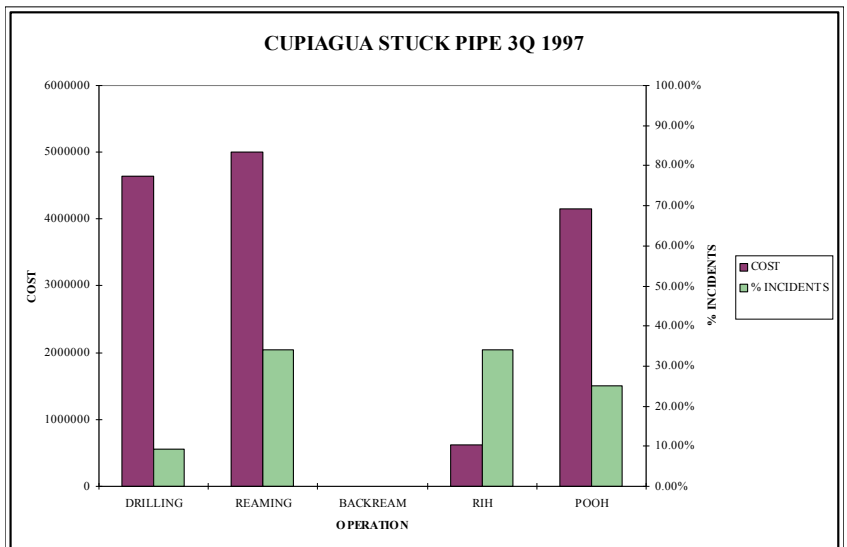
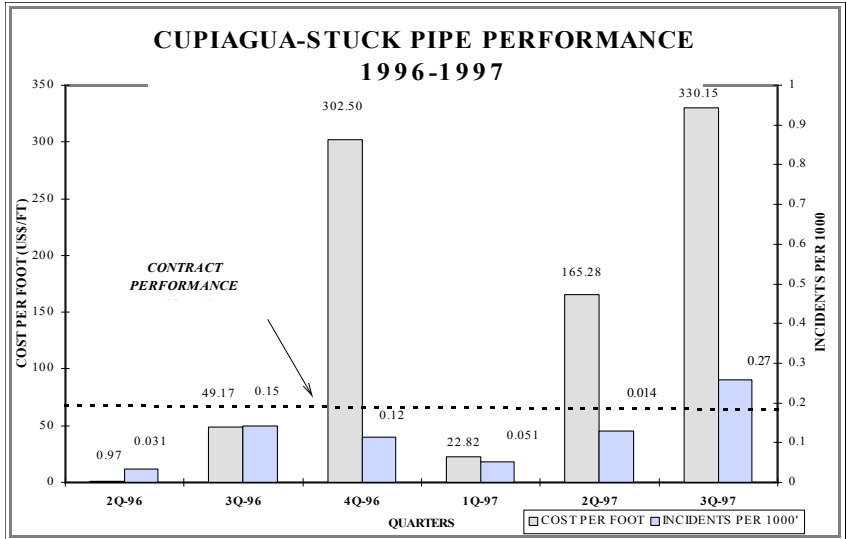
D. RECENT STUCK PIPE STATISTICS

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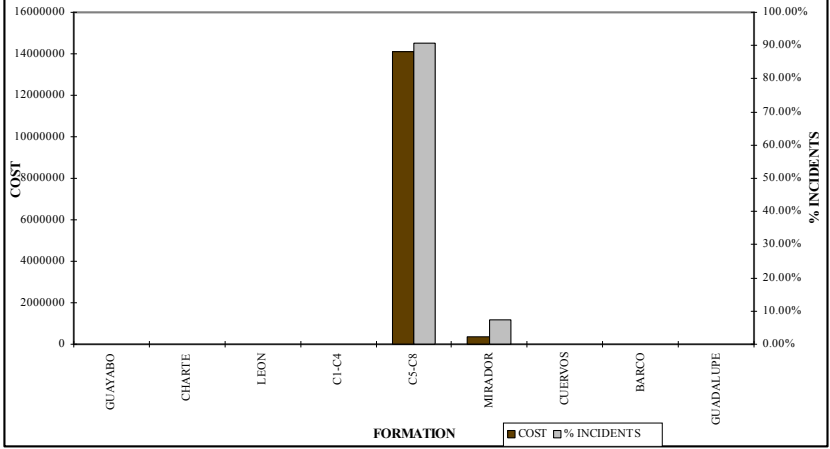




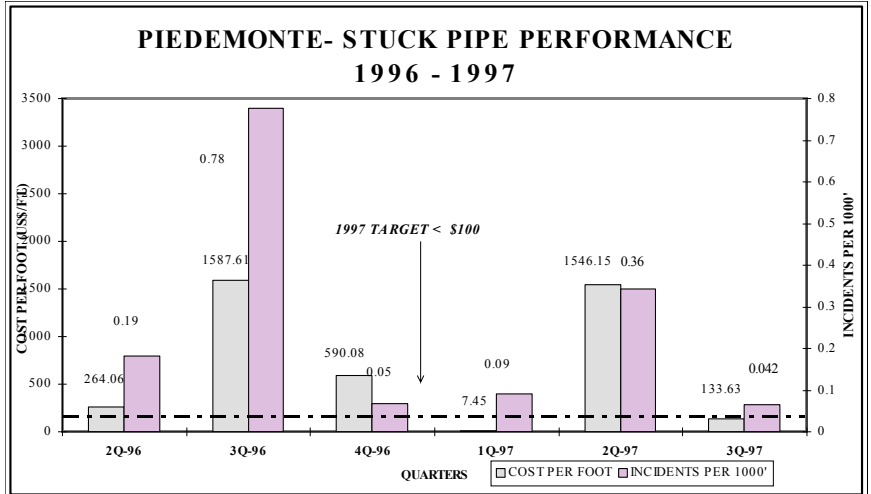
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PIEDEMONTE



E. STUCK PIPE/TIGHT PIPE INCIDENT REPORTING FORM

Page 1 of 2

WELL NAME		WELL TYPE		SPUD DATE		DIRECTIONAL PROFILE
RIG NAME		RIG TYPE		DRL. CONT.		
STICKING INCIDENT:						
Date	Time	MD of Well	Depth of Bit	Stuck Point	Hole Size	
Hole Angle	Mud Weight	Mud Type	Flowrate	Overbalance	Formation	
BOTTOM HOLE ASSEMBLY:						
TIME SINCE CREW CHANGE:						
Drl. Supv.	Toolpusher	Driller	Dir. Drl.	Mud Eng.	Mud log.	Rigsite DE
OPERATION INSTANT HOLE GOT TIGHT/STUCK:						
SUSPECTED CAUSES:						
<input type="checkbox"/> Differential Sticking	<input type="checkbox"/> Key Seating	<input type="checkbox"/> Reactive Formation	<input type="checkbox"/> Frac/Faulted Formation	<input type="checkbox"/> Mobile Formation	<input type="checkbox"/> Unconsol. Formation	<input type="checkbox"/> Geopressured Formation
<input type="checkbox"/> Junk	<input type="checkbox"/> Well Geometry	<input type="checkbox"/> Hole Cleaning	<input type="checkbox"/> U/Gauge Hole	<input type="checkbox"/> Green Cement	<input type="checkbox"/> Cement Blocks	<input type="checkbox"/> Collapse Casing
WARNING SIGNALS						
	YES	NO	REMARKS			
Size/Amount of Cuttings over Shakers	<input type="checkbox"/>	<input type="checkbox"/>				
Previous tight connections:	<input type="checkbox"/>	<input type="checkbox"/>				
Increased Torque:	<input type="checkbox"/>	<input type="checkbox"/>				
Increased Drag:	<input type="checkbox"/>	<input type="checkbox"/>				
Mud losses:	<input type="checkbox"/>	<input type="checkbox"/>				
Change in Formations:	<input type="checkbox"/>	<input type="checkbox"/>				
Change in Pump Pressure:	<input type="checkbox"/>	<input type="checkbox"/>				
Change in Mud Properties:	<input type="checkbox"/>	<input type="checkbox"/>				
Change in Formation Pressure:	<input type="checkbox"/>	<input type="checkbox"/>				
LOST TIME (HRS): HOURS			L.I.H. COST (\$):			
LOST TIME COST (\$):			TOTAL COST (\$):			

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STUCK PIPE/TIGHT PIPE INCIDENT REPORTING FORM

Page 2 of 2

ACTIONS TAKEN BEFORE STICKING INCIDENT:

ACTIONS TAKEN AFTER PIPE BECAME STUCK:

HOW COULD THIS STUCK PIPE INCIDENT HAVE BEEN PREVENTED:

PLANNED ACTION TO BE TAKEN / RECOMMENDATIONS:

WHAT PRECAUTIONS CAN THE STUCK PIPE TEAM TAKE TO PREVENT A RECURRENCE:

HOW CAN THE LESSONS LEARNED FROM THIS INCIDENT BEST BE TRANSFERRED TO OTHER AREAS:

WELL :						DRILLER HANDOVER NOTES							DATE :	
Rig :						Driller :							Tourpusher :	
Last Csg OD :						Shoe MD :			Shoe PPG :				Hole Size :	
Initial O/P						Jar Trip : Up			Dwn :				Max String O/P	
DEPTH OF SLOW PUMP RATE					DEPTH OF SLOW PUMP RATE					DEPTH OF SLOW PUMP RATE				
PUMP #		PUMP #			PUMP #		PUMP #			PUMP #		PUMP #		
SPM	PRESSURE	SPM	PRESSURE		SPM	PRESSURE	SPM	PRESSURE		SPM	PRESSURE	SPM	PRESSU RE	
TIME	OPERATION	DEPTH	ROP	Cavings BBL/HR	Rotating Weight	Pick Up Weight	Slack Off Weight	RPM	Off/B Torq	WOB	On/B Torq	SPM	CIRC PRESS	
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TRIP INFORMATION	
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NOTES & DRAWINGS :

G. INFORMATION ON FORMATIONS IN COLOMBIA

Data to be added later