Top Hole drilling Hazards: Historical Consequences, Lessons & Future Strategies

VK Gupta, GM(D)-IDT,
Top Hole drilling hazards in E&P Industry

“Top Hole drilling Hazards: Historic consequences, lessons & Future Strategies

OISD Workshop: 25th-26th Nov.’2013
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Case-Histories-i : LPDK</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Case-Histories-ii : TKAB</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Case-Histories-iii : LKFT</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lessons &amp; Strategies</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Technology Measures</td>
<td></td>
</tr>
</tbody>
</table>
Top Hole drilling hazards

Introduction

- Seepages during top hole drilling resulted some serious consequences, in Hydrocarbon industry.
- Continued channeling caused fragility around well bore, resulting instability and route to flow.
- Loss of Rig and Well reported in some cases in last two decades in ONGC.
Case-I : LPDK :

- Target- Depth : 3885m {Dev.} / DD: 1334m
- Csgs.- Plan/Act. : 20” - 300m / 65m (short landed)
  : 13⅜” - 2460m / Nil
  : 9⅜” - 3460m / Nil
  : 7”Liner - 3885m / Nil

- 70 Rig-days lost.
Case-I : LPDK :

- Spudded on 02\textsuperscript{nd} Sept.’2006.
- Drilled 26” hole to 305m.
- Seepage observed from rat hole annulus.
- Evacuated mud from cellar pit to mud tank.
- Lowered 20” Casing to 87m. Observed Held-up.
Case-I : LPDK :

- During Casing Pull-out, three side walls of cellar pit collapsed. Reconstructed the same.
- Run in 26” bit, Held-up again at 15m.
- Pumped 14T cement in conductor annulus.
- Cut window in 30”conductor for returns.
Case-I : LPDK :

- Filled cellar pit adjacent area with sand & soil.
- Cleared hole to 145m.
- Could lower 20”Csg. upto 65m. H/up. Cemented.

17½” Drilling :

- Drilled 17½” hole to 1334m.
- Obsd. mud seepages from out side of cellar pit.
Top Hole drilling hazards in ONGC

Case-I : LPDK :

- Pumped 20T cement @72 m to arrest seepage.
- Tagged cement at 32m & Cleared to 456m.
- Subsequent held up@110m could not cleared.
- Abandoned . Rig Released on 23rd Nov.’06.
- While lowering mast all the nuts of 16 bolts of base plate came out and Mast fell to ground.
Case-I \{LPDK\} : Conclusions:

- Seepages prior lowering 20”casing not arrested.
- F/Conductor grouting deeper, may have helped.
- 20”Casing short landed @65m due to **collapsing** the hole, which continued all through thereafter.
- Amid continued seepages, foundation (tilt) should have been obsvd. for deviations, to avoid disaster.
Top Hole drilling hazards in ONGC

Case-II : TKAB :

- Rig: E-1400-12 {Expl.} : Silchar : March’2010
- Target- Depth : 3500m / DD: 2387m
- Csgs.- Plan/Act. : 20” - 500m / 503m
  : 13⅞” - 1900m / 1795m
  : 9⅜” - 2650m / Nil
  : 7”Liner - 3500m / Nil

- 90 Rig days lost.
Case-II : TKAB :

- On 4th Aug.’10@2387m in 12¼” Hole : While P/o Obsd. **Gushing-water** in Cellar pit. **No Activity**.
- BOP closed as precaution.
- DS evacuated, observing erosion at cellar pit.
- Bottom Box sank. **Rig tilted & Toppled**.
- Flow continued at cellar pit area for over 24Hrs

Silchar Seepage-1.mpg   Silchar Rig Fall.mpg
Top Hole drilling hazards in ONGC

Case-II : TKAB : Conclusions

• A Water source found outcropped high up in a adjoining mountain area.

• Artesian effect resulted higher water pressures.

• Weaker & permeable soil caused gushing in & around well bore, followed by toppling of Rig.

• Site area survey for flowing underneath river, could have been helpful.
Top Hole drilling hazards in ONGC

Case-III : LKFT - 1\textsuperscript{st} Phase:

- Rig: F-6100 \{DEV.\} : Sibsagar : Dec.’2012
- Target- Depth: 4082m / DD: 554m
- Csgs.-Plan /\textbf{Actual} : 20” - 500m / 503m
  : 13\(\frac{3}{8}\)” - 1900m /
  : 9\(\frac{5}{8}\)” - 3460m /
  : 5\(\frac{1}{2}\)” - 3885m
- 60 Rig days lost.
Case-III: LKFT - 1st Phase:

- Well was spudded on 4th Oct.’2012
- Drilled 26” hole to 18m.
- Heavy seepage observed near cellar pit area.
- Repeated cement jobs done.
Case-III: LKFT - 1st Phase:

- Drilled 26” hole to 233m.
- Seepage again observed near cellar pit.
- 20” casing held up at 15m. Pulled out casing.
- Large crater found near foundation.
- Filled cement in hole and tagged at 10m.
Case-III: LKFT - 1st Phase:

- Drilled upto 255m.
- Seepage observed again.
- 20” casing R/I, held at 30m again.
- While P/o csg., false conductor came out and cellar pit & nearby area sank by 3 to 4 feet.
Case-III : LKFT - 1st Phase :

- Cut 4m of conductor. Remaining conductor sank in well.
- Grouted new conductor above existing sunk one
- Repeated Cement job done to strengthen the cellar pit & surrounding.
- Minor gap noted below Bottom Box. Placed Wedges.
Top Hole drilling hazards in ONGC

Case-III : LKFT - 1st Phase :

- RI bit and held-up @17.66m. No return.
- Squeezed Cement.
- 17½” Bit held up @17.3m. Cleared to 255m.
- Lowered 20” Csg.@75m. Cemented.
- Drilled 17½” hole to 554m, losing 60 Rig days.
- Later completed successfully & flowed HC.
Case-III : LKFT : Conclusion

- Deeper conductor may have avoided seepages.
- A pilot hole drilling could have resulted relatively controlled situation.
- Foundation gap may have caused detrimental consequences , averted by careful monitoring.
Lessons learnt / Future strategies :

If site is located at hillock, extensive area survey should be done for detecting artesian conditions, accordingly location is decided.

At suspected locations:

1. 30” or 20” Conductor casing should be lowered deeper to about 25-30m by civil contractor.
Lessons learnt / Future strategies:

3. A pilot hole of atleast 17½” / preferably 12¼” is drilled for controlled monitoring.

4. Stronger pile / alternatively stronger foundation is laid for bottom box at suspected locations.

5. Proper cementation is ensured against surface casing to avoid subsequent adversities.
Top Hole drilling hazards in ONGC

Technology Measures:

1. Newer DF/Cement additives like Micro-Bubble is tried depending upon feasibility.

   - **Micro-Bubbles / Aphrons**: Proven for fluid loss control, formation damage & differential sticking.

   - Aphron-based DF combines certain surfactants in the fluid to convert entrained air into aphrons / highly stabilized micro-bubbles.
Top Hole drilling hazards in ONGC

ONGC: Globally recognized expertise in Hydrocarbon world
Top Hole drilling hazards in ONGC

Technology Measures:

2. “Polygrouting”: A latest technology solution to susceptible locations, where polymer:
   a) Expands 300 to 400 times by volume.
   b) Temporary Barrier for effective cement job.
   c) Swells in less than minutes on water contact.

Issues with Polygrouting:

i. Placement problematic although use of Cement pump recommended

ii. Based on water quantum & reactivity, dilution & Poly glycol treatment / Formulation decided
THANK YOU