Risk Analysis Significantly Reduces Drilling Project Costs: Vital in the New Oil Price Era

Michael Gibson, IDEAS Singapore Pte Ltd
CONTENT

• Introduction
• The Challenge
• The Authority’s View
• Advantages to Operator
• Risk Analysis Work
• Key Result & Conclusions
AS ALWAYS OFFSHORE . . .
WE WANT TO ACHIEVE ...
MAXIMUM SAFETY
MAXIMUM EFFICIENCY
MAXIMUM OIL / GAS
MAXIMUM ENVIRONMENTAL REPUTATION
MAXIMUM PROFIT
WE CANNOT AFFORD LOSS OF :-

- Human Life
- Rig / Asset
- Coastal Marine Life
- Onshore Wildlife
- Agricultural Land
- Marine Fisheries
WE CANNOT AFFORD LOSS OF :-

- Environment
- Oil & Gas Production
- Infrastructure
- Profits
- Company Reputation
- Industry Reputation
UNTOWARD EVENTS CAN ALSO INCREASE :-

- Increased Insurance
- Drop in Share Price
- Increased Regulation
- PR Difficulty
- Hiring Difficulty
- Loss of Licenses
FOR TODAY’S WELLS . . .
THE CHALLENGE
THE CHALLENGE

Is a 10,000 psi rated rig suitable for the drilling of a 9,450 psi SIWHP well?
SPE-176405-MS • Risk Analysis Significantly Reduces Drilling Project Costs: Vital In The New Oil Price Era • Dr Michael Gibson
THE CHALLENGE
Surely a 15,000 psi rated rig should be used?
THE AUTHORITY’S VIEW
THE AUTHORITY’S VIEW :-

If the risks associated with :-

• The Drilling Programme
• Well’s Design
• Rig Equipment
• Personnel
• ALARP (D & C Regs)
• HSE Will Consider
The well operator shall ensure that the well is so designed, constructed, equipped and operated so that:-
THE DESIGN & CONSTRUCTION REGS :-

a) So far as is reasonably practicable, there can be no unplanned escape of fluids from the well, and...

b) The risks to the health & safety of people must be as low as reasonably practicable.
ADVANTAGES TO OPERATOR USING THIS RIG
ADVANTAGES TO OPERATOR

- Rig already on contract
- Excellent performance track record
- Only expensive 15,000 psi rated rigs available
- Operator able to fulfill license terms
- Significantly reduced cost
RISK ANALYSIS WORK
EXPERT TEAMS
STEP 1 : ESTABLISHING THE RISK & RISK IDENTIFICATION FRAMEWORK
RISK ANALYSIS

- All risks identified and assessed
- All control / mitigation measures identified to remove / reduce risks
- All actions followed up
- Formal auditable record
Steps 1 & 2
Framework & Risk Identification

Steps 3 & 4
Input Data & QRA: 2,968 Inputs

Risks: 332 Key Risks

Step 5

Final Conclusions

Step 6
STEP 2 : IDENTIFICATION OF RISK CHARACTERISTICS
RISK ANALYSIS

- Major hazards identified
- Risks evaluated
- Management Systems
- Risk reduction to ALARP
- Audit & Reporting
STEP 3 : DATA SOURCING / INPUT DATA
RISK ANALYSIS

- The Worldwide Offshore Accident Databank
- Accident Statistics, HSE
- Blowout Frequencies, Sintef
- Blowouts During Operations, Scandpower
STEP 4: QUANTITATIVE RISK ANALYSIS METHODOLOGY
Data Input Screen

- Activity Title
- Activity Description
- Activity List
- Risk Title
- Risk Description
- Risk Consequences
- Risk Recovery Actions
- Risk Mitigation Actions
- Risk Recovery Time (Minimum, Most Likely, Maximum)
- Risk Tolerability
- Risk Probability
- PDF Shape
- Risk Register
- Risk Impact
- Add / Remove Activities / Risks
- No Risk Time
- Risk Probability
- Risk Tolerability
Graph Screen

Switch To Input Screen

Activity List

Graphical Display

Risk Title

Select Graph Type

Generate Report
Select Activities to appear in report

Select Graphs to appear in report
Step 1: Select ‘New Project’

Choose ‘Impact Analysis Only’

Please choose the type of analysis required:

- Both Impact and Cost Risk Analysis
- Impact Analysis only
- Cost Risk Analysis only

Proceed
Step 2 : Enter Data into Risk Register

Note: Only input boxes for Impact Analysis appear
Step 3 : View Results

Safety Factor Bar Graph selected

Generate Report

Safety Factor Bar Graph for Activity 6

Activity 6 selected
<table>
<thead>
<tr>
<th>Reference</th>
<th>Risk Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1/A8/R5</td>
<td>Burst casing during well control event</td>
</tr>
<tr>
<td>P1/A25/R1</td>
<td>Non-understanding of blowout scenarios</td>
</tr>
<tr>
<td>P1/A26/R15</td>
<td>Mis-calculation of MAASP</td>
</tr>
<tr>
<td>P1/A26/R16</td>
<td>Mis-calculation of maximum WP at top of annulus (P.max)</td>
</tr>
<tr>
<td>P1/A29/R8</td>
<td>Failure of casing</td>
</tr>
</tbody>
</table>
# Operational Issues – Key Risks

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1/A23/R12</td>
<td>Non recognition of underground blowout</td>
</tr>
<tr>
<td>P1/A24/R3</td>
<td>Poor operational procedures (e.g. Snorre incident and Saga 2-4/14 blowout)</td>
</tr>
<tr>
<td>P1/A24/R4</td>
<td>Poor or zero evacuation support</td>
</tr>
<tr>
<td>P1/A25/R3</td>
<td>No overall control philosophy</td>
</tr>
<tr>
<td>P1/A28/R1</td>
<td>OIM makes poor judgement / does not follow procedure</td>
</tr>
<tr>
<td>P1/A28/R2</td>
<td>Company Drilling supervisor makes poor judgement / does not follow procedure</td>
</tr>
<tr>
<td>P1/A28/R3</td>
<td>Toolpusher Ditto</td>
</tr>
<tr>
<td>P1/A28/R4</td>
<td>Driller Ditto</td>
</tr>
<tr>
<td>P1/A33/R3</td>
<td>Combination of continual losses &amp; continual influx</td>
</tr>
<tr>
<td>P1/A38/R1</td>
<td>Non-awareness of $H_2S$</td>
</tr>
</tbody>
</table>
### Equipment Specific Issues – Key Risks

<table>
<thead>
<tr>
<th>P1/A2/R5</th>
<th>Failure of 10 K Annulars</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1/A2/R7</td>
<td>Failure of whole well control system</td>
</tr>
<tr>
<td>P1/A3/R6</td>
<td>Erosion of surface equipment due to high flow rates</td>
</tr>
<tr>
<td>P1/A7/R3</td>
<td>Drilling into Lost Circulation Zone with gas reservoir above and not being able to shut well in through mal-functioning equipment</td>
</tr>
<tr>
<td>P1/A17/R1</td>
<td>The BOP stack including flexible hoses has not been pressure tested to their full working pressure on the test stump prior to running. (Failure of the BOPE could be catastrophic in an untoward event)</td>
</tr>
<tr>
<td>P1/A17/R2</td>
<td>Hoses not visually inspected externally and in accordance with manufacturers recommendations when stack is moved</td>
</tr>
<tr>
<td>P1/A23/R19</td>
<td>Failure of BOPE</td>
</tr>
<tr>
<td>P1/A24/R2</td>
<td>Failure of Well Control Equipment</td>
</tr>
<tr>
<td>P1/A29/R1</td>
<td>Failure of Diverter System</td>
</tr>
<tr>
<td>P1/A29/R3</td>
<td>Failure of BOP System</td>
</tr>
<tr>
<td>P1/A31/R2</td>
<td>Gas not be detected in the atmosphere of the shale shaker room</td>
</tr>
<tr>
<td>P1/A31/R3</td>
<td>If H₂S in is the atmosphere, it may not be detected by equipment (due to equipment failure)</td>
</tr>
<tr>
<td>P1/A31/R4</td>
<td>Breathing equipment is non-operable or is not sufficient in quantity</td>
</tr>
<tr>
<td>P1/A31/R6</td>
<td>Overboard effluent line washes out</td>
</tr>
<tr>
<td>P1/A31/R8</td>
<td>Glycol Injection System Fails</td>
</tr>
</tbody>
</table>
### Report Excerpt

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1/A8/R1</td>
<td>Nominal wear of casing if no casing wear protectors used</td>
</tr>
<tr>
<td>P1/A8/R2</td>
<td>Nominal wear of casing if casing wear protectors used</td>
</tr>
<tr>
<td>P1/A8/R3</td>
<td>Severe casing wear if no casing wear protectors used</td>
</tr>
<tr>
<td>P1/A8/R4</td>
<td>Severe casing wear if casing wear protectors used</td>
</tr>
<tr>
<td>P1/A8/R5</td>
<td>Burst casing during well control event</td>
</tr>
<tr>
<td>P1/A8/R6</td>
<td>Necessity of having to run liner tie-back prior to well test operations should there be wear</td>
</tr>
</tbody>
</table>
STEP 5 : RISKS LISTING
RISK ANALYSIS

332 risks identified in areas of:-

• Well Data & Design
• Operational Issues
• Equipment Issues
With all risks identified, risk mitigation / elimination through design, systems and process could begin.
KEY RESULT
The well could be drilled since, per UK HSE Policy, all risks were assessed & addressed through:-

- Engineering & Well Design
- Operational Procedures & Training
- Management Systems
- Rig Partial Upgrade (though still 10k BOPE)
CONCLUSIONS
OPERATOR GAINS

- Rig performance proven
- Accelerated field appraisal
- Focused cash-flow
- Defined field development
- Improved, safer drilling
- Significantly reduced cost
DRILLING CONTRACTOR GAINS

- No cost rig equipment upgrade
- Continued contract
- Personnel experience in drilling near HP well
- Easier to market rig to next Operator
SHIPYARD & INSURANCE GAINS

- Shipyards gain through revenue
- Insurance companies gain due to lowered drilling risk
INDUSTRY GAINS

- Significantly reduced blowout likelihood
- Improved drilling safety
- Improved perception of the industry
Such Risk Impact work is most definitely applicable for projects in South East Asia where similar economic & safety benefits would result through knowledge transfer.
THANK YOU!

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