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TODAY’S CHALLENGE
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BACKGROUND & INTRODUCTION
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IADC / SPE 180589 • Risk Impact Analysis Maximizes Safety & Efficiency • Dr. Michael Gibson

BOSTON SQUARE / P-I MATRIX

<table>
<thead>
<tr>
<th>Probability Factor</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Slight (1)</td>
</tr>
<tr>
<td>Very Likely (5)</td>
<td>5</td>
</tr>
<tr>
<td>Likely (4)</td>
<td>4</td>
</tr>
<tr>
<td>Possible (3)</td>
<td>3</td>
</tr>
<tr>
<td>Unlikely (2)</td>
<td>2</td>
</tr>
<tr>
<td>Very Unlikely (1)</td>
<td>1</td>
</tr>
</tbody>
</table>
BLOWOUT COSTS

- Human Life
- Marine Life
- Environment
- Equipment / Rig / Assets
  - Oil & Gas Production
  - Company Reputation
  - Industry Reputation
  - PR Difficulty
- Increased Insurance Costs
- Increased Regulations
RISK METHODOLOGY

• Step 1 – Establishing the Risk & Risk Identification Framework
  • Step 2 – Identification of Risk Characteristics
    • Step 3 – Data Sourcing / Input Data
    • Step 4 - Quantitative Risk Analysis Methodology
      • Step 5 – Risk Mitigation
      • Step 6 – Final Conclusions Derivation
RISK METHODOLOGY

Step 6
Final Conclusions

Step 5
Risks: 332 Key Risks

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

Steps 1 & 2
Framework & Risk Identification
RISK METHODOLOGY
RISK METHODOLOGY

The bar chart shows the safety factor for different risk components:

- A1/R1: Safety Factor = 0.6
- A1/R2: Safety Factor = 1.0
- A1/R3: Safety Factor = 0.1
- A1/R4: Safety Factor = 0.9
ALARP?

Safety Factor

A1/R1
A1/R2
A1/R3
A1/R4

Risk Component
# Data & Well Design – Key Risks

<table>
<thead>
<tr>
<th>Code</th>
<th>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>Risk 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 H₂S</td>
</tr>
</tbody>
</table>
CONCLUSIONS

• Today’s Challenges are Severe
• There is a tendency to cut cost
  • Are you absolutely sure there is no blowout risk?
  • Many risk methodologies used are unacceptable
• Very detailed QRA may very well stop blowouts and loss of life
  • Quality of work should never be compromised
  • Actually, everybody gains through thorough work
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Thank You / Questions