Repsol well design and risk mitigation processes, the case of HPHT Jaguar-1 well (Guyana).
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Repsol . Regional Direction Exploration Latin America. 04/23/2015
1. Repsol Drilling Risk Mitigation Processes

- **PRE**
  - Well planning
  - Risk identification and prevention tools

- **DURING**
  - Execution
  - Emergency Management
  - Critical Response Resources

- **POST**
  - Environmental and Socio-economic Restoration
  - Business Continuity
RPSOL Drilling Risk Mitigation Processes
PRE: Well Planning & Construction Process

Subsurface studies
- Basic well design
  - Visualization
  - Conceptualization
- Detailed well design
- Well Execution

TRSI-Subsurface information
TRWC-Well construction process

Well Design Options
Well Integrity
BoWD
Well Containment

PA
PA
PA
PR
PA

EXP Studies
Project initiation
Options design
Basic engineer
Basis of Design
Well Program
Well design
Spud
Well drilling
Testing

Form project team
Prelim. Subsurf Info. for Well Design
Order LLI (if required)
Option selection
Tender & Purchase
PDDP
TR
TR

Emphasis on Geohazard Prediction
Reviewed by Global Experts Team
Approved by central Assurance Group

12 to 24 months -------- 10’s people ------- Multi-M$ engineering
Repsol Drilling Risk Mitigation Processes
PRE: Drilling Hazard Identification and Prevention

WELL PLANNING HAZID

MAH BOW-TIE REVIEW

MAJOR HAZARD IDENTIFICATION

Figure 1: Example Bow Tie diagram

**DEFINE:**
- Threat Controls
- Recovery Measures
- Escalation Factors
Risks of change processes during technical standards, supervision, and MOC.
Repsol Drilling Risk Mitigation Processes
DURING: Global Critical Emergency Management
Repsol Drilling Risk Mitigation Processes
DURING: Critical Response Resources

GLOBAL CRITICAL RESPONSE TEAM
- Modularity
- Training
- Quick Activation

GLOBAL WELL CONTAINMENT STRATEGY
Wild Well Control Inc. MSA

RESPONSE ASSETS
Critical Management Centres & Situation Rooms
Located in Madrid, Houston, Port of Spain, Lima and Rio de Janeiro

OIL SPILL RESPONSE STRATEGIES
- Local – MAA
- Regional – OSRL (USA)
- Global – OSRL (UK)
Repsol Drilling Risk Mitigation Processes
POST: Recovery & Continuity

✔ RECOVERY
  ▪ Environmental and Social Restoration
  ▪ Compensation

✔ BUSINESS CONTINUITY – Lessons Learned
  ▪ Restructuring of the organization
  ▪ Realignment of the strategy
Remote area supported by Trinidad and Tobago at 450 miles.
Previous to the drilling of Jaguar-1, only one additional well had been drilled offshore in Guyana in 20 years.
Very good level of Cooperation by Local Authorities.
Repsol Drilling Risk Mitigation Processes

The Jaguar 1 Well Case: PRE

- Drilling Tender Process – Contract Awarding
- Logistics Plan
- HSEQ Plan
- Well Options
- Basic Engineering Design
- HAZID
- HPHT Well Definition
- LOI – Atwood Beacon
- Detailed Engineering & Drilling Design
- DWOP & HPHT Cert.
- Pre-Spud
- TR-1
- TR-2
- TR-3
- MOB
- SPUD
- Drilling
- Rig Released
- Final Well Report
- Aberdeen Drilling School Ltd

Project 100% Core Team = 35 people (extended team +20)
Repsol Drilling Risk Mitigation Processes

The Jaguar 1 Well Case: DURING

CASING DESIGN

CASING ACTUAL

Well Total Depth = 15,998 ft

Prognosed Depth = 21,445 ft

MOC - Management of Change
1. - 11 ¾ CSG due to high PP
2. - 9 5/8 conversion CSG into Liner
3. - Well abandonment

Pore Pressure (psi)

Estimated Pore Pressure = 11,588 psi
Actual Max. Pore Pressure = 15,545 psi

+34%

Oil Sample at 15,442 ft
Oil Sample at 15,955 ft

Pre-drill Pore Pressure
Actual Pore Pressure
Repsol Drilling Risk Mitigation Processes

The Jaguar 1 Well Case: POST

**Georgetown**
- Plug and Abandon Decision - Successful
- Project Cost US$ 230 Million
- Feasibility Studies Jaguar-2 Positive
- Georgetown Block Contract - Expired

**Kanuku**
- Kanuku Block – New Contract
- Partners & Government aligned to redirect the project towards lower pressure environments
- New 2D & 3D Seismic Campaign – US$ 30 Million

New Prospects Search in progress

Reduced Risk
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