From: Liao, Tony T  
Sent: Mon Jul 12 22:51:27 2010  
To: Mason, Mike C  
Subject: Overview of Macondo Well Modeling 12July2010.ppt - updated...  
Importance: Normal  
Attachments: Overview of Macondo Well Modeling 12July2010.ppt  
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Hi Mike,

Please refer to the updated version of the slides I prepared. Please note this version included feedback from Chris. Bob saw the earlier version.

See you tomorrow.

Best regards,
Tony Liao
APPROACHES TO CHALLENGES

- Complicated fluid behavior: Worked with PVT vendors to confirm lab measurements, used the most up-to-date equation of state model in all engineering calculations.

- Fluid flow paths: Investigated all possibilities the flow paths
  - Inside casing, behind casing in the annulus, ... focused on 4-

- Uncertainties on oil production rate: Estimated ranges of oil rates based on possible range of reservoir parameters

- Permeability, reservoir thickness open to challenge.
APPROACHES TO CHALLENGES

- **TOP KILL OPERATIONS**: investigated well behaviors using additional data collected during top kill operations
  - Added BP proprietary drilling mud model in GAP via OpenServer
- **SHUT-IN WELLHEAD PRESSURE**: constructed a network model for the surface system considering:
  - Reservoir depletion using VIP simulations
  - Possible flow paths and cross flow
  - Different oil flow rates prior to shutin
  - Transient pressure and temperature responses after shutin

Temperature Profile During Shut-in (SIWHP)

Shut-in Wellhead Pressure - OLGA & Prosper

SIBHP
OTHER AREAS OF INVESTIGATION...

- HYDRATE POTENTIAL IN THE 6" RISER FROM WELLHEAD TO THE ENTERPRISE
- TRANSIENT THERMODYNAMICS INVESTIGATION (DETAILED ENTHALPY MODEL)
- BROACH TO THE FORMATION NEAR THE 18" CASING SHOE
- STATUS OF AND POSSIBLE FLUID FLOW RATES THROUGH THE RUPTURE DISKS ON THE 16" CASING
- POTENTIAL FRACTURE OF THE SHALE NEAR THE 9 7/8" CASING NEAR THE BOTTOM OF THE WELL
- RESERVOIR DEPLETION CALCULATIONS FOR RELIEF WELL PLANNING
- INJECTIVITY ASSESSMENT FOR ALTERNATIVE DISPOSAL ROUTES
- ROLE WITH NATIONAL LABS
  - DATA EXCHANGE AND EXPLANATIONS
  - SOFTWARE AND METHODOLOGY EXPLANATIONS
  - COLLABORATION ON ASSUMPTIONS AND ANALYSES IN JOINT WORK SESSIONS
- MANAGEMENT PRESENTATIONS (INGLIS, SALAZAR, DUPREE, AND CHU)
Approaches to Challenges in Macondo Well Modeling

Presented on July 14th, 2010

Presented by EPT Base Management Team
Approaches to Challenges

➢ Complicated Fluid Behavior: worked with PVT vendors to confirm lab measurements, used the most up-to-date Equation of State model in all engineering calculations

➢ Fluid Flow Paths: investigated all possibilities of the flow paths
  • Inside casing, behind casing in the annulus, ...focused on 4-

➢ Uncertainties on Oil Production Rate: estimated ranges of oil rates based on possible range of reservoir parameters
  • Permeability, reservoir thickness open to flow, skin,...

➢ Rate changes with removal of the damaged riser: model the well rates with and without the damaged riser
Approaches to Challenges

- Require data. Field and fluid tests into different reservoirs.
- Subsurface system with integrity (no leak failure).
- Transient pressure and temperature responses after shutin.
- Different oil flows prior to shutin.
- Possible low pressure and cross flow.
- Reservoir depletion using VP simulations.
- Shunt in wellhead pressure constraints: adjusted field model for the surface system constraints.
- Added dp properties during the model in CAPE vs Operator.
- Top Kill Operation: investigated well behavior using additional data collected during top kill operations.
Management presentations (Hughes, Salazar, Dupree, and Chu)

- Collaboration on assumptions and analyses in joint work sessions
- Software and methodology explanations
- Data exchange and explanations
- Role with National Labs
- Initial assessment for alternative disposal routes
- Reserve depletion calculations for better well planning
- Potential leakage near the shale near the 9 7/8" casing near the bottom of the well
- Shales or and possible fluid flow paths through the penetrate chucks on the 16" casing
- Break in the formation near the 18" casing shoe
- Transient thermodynamic investigation (detailed enthalpy model)
- Hydrate potential in the 6" layer from wellhead to the Enterprise...

Other Areas of Investigation...