BOEMRE Permitting Workshop
WCST Panel Discussion
Level 2 Considerations
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Noble Energy Recent Deepwater Permitting

- 2 completion permits approved during the moratorium
- 2 drilling permits, 1 completions APM post moratorium
  - Development by-pass approved February 28, 2011
  - Completion APM approved in May 27, 2011 (2 days)
  - Exploration sidetrack approved July 22, 2011
- 1 appraisal well permit currently being reviewed.
Recent Permitting Experience

- Ensure all data is complete and consistent prior to submitting.

- Organization is learning as we go, takes significantly more man hours to get permit ready.

- Internal training to fulfill new permitting requirements (WCP, WCST, attachments, etc).

- Expect revisions during review process.

- Document learnings to prevent repeat mistakes.

- When in doubt, call BOEMRE and ask for clarification.
Level 1 Collapse SF <1

Does shut-in pressure exceed frac pressure at highest collapse point?

Consequence analysis
- Conduct broaching study
- Consider secondary string failure
- Any sands accept flow?

Is collapse SF ≥1 with simulated grads?

Can higher collapse rating be used?
- Different pipe grade/ weight?
- Advanced calcs./testing

Can low collapse interval be covered by scab liner /tie-back?

Trapped Annulus?

Perform nodal Analysis for actual fluid gradients using PVT data

Fluids broach mud line?

Collapse analysis is complete.

Trapped annulus screening (cement or barite)
- Perform APB analysis
- Can entire string be cemented?
- Can TOC be moved down or confirmed with CBL to prove annulus open?
- Justify no trap annulus through a settling study, empirical data, or case study?

Change entire casing design
- Casing sizes / grades
- Setting depths

Run scab liner /tie-back

Well can be shut-in collapse analysis complete

Perform Cap & Flow analysis
Level 1 Burst SF <1

Burst analysis complete

Yes

Use new pipe / hanger burst analysis complete

Yes

Can increase SF≥1 by
Non-API burst ratings?

No

Use current design

Does Nodal analysis gradients increase SF≥1?

No

- water, oil, gas

Yes

Burst analysis complete

If gradients can be justified
- Offset PVT data

Can sand take volume of flow?

Yes

Well can be shut-in burst analysis complete

No

Does any sand below shoe fracture before pipe bursts?

Yes

Conduct broaching study

Can pipe or hanger weight/grade be changed for SF≥1

No

Cemented pipe
Should allow well to be shut-in

Can pipe be fully cemented?

Yes

No

Can scab liner /tie-back be run?

Yes

Run scab liner / tie-back

Can flow broach ML?

No

Can heavier mud be left in annulus?

Yes

No

Objective: move failure pt deeper

Well can be shut-in burst analysis complete

Cap & Flow Analysis
Questions / Open Discussion
Broaching Study Elements

- Executive summary stating conditions evaluated and findings
- Broaching Analysis considering the following
  - Mapping of major and minor faults (sealing / non sealing, ability to transfer fluid)
  - Ability of pressure to exceed net pressure to propagate fracture of significant length.
  - Orientation of fracture with respect to faulting.
  - Presence of sand to except flow rate/volume and prevent vertical fracture.
- Conclusion of findings
- Appendix with supporting data (maps, calculations, etc.)