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Analysis of Formation Tester Tool Application in HPHT Deepwater Wells and Hydrogen Sulfide Measurement

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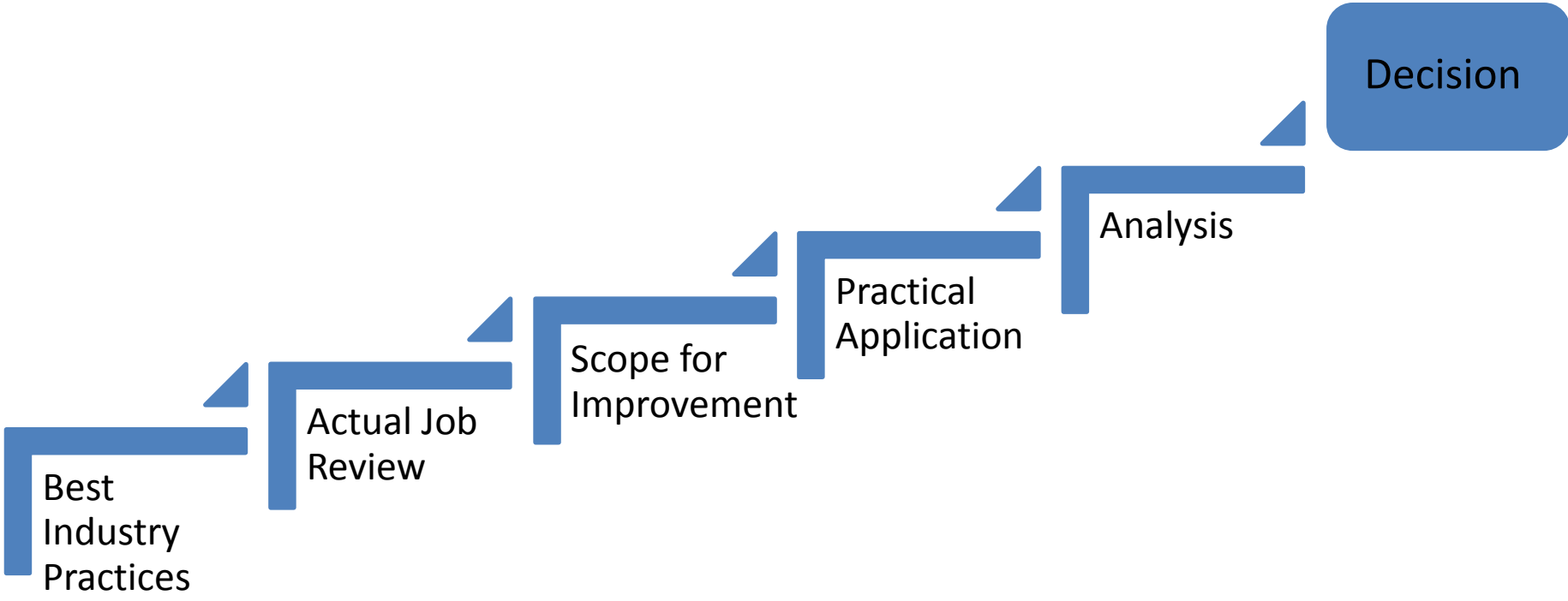
Background

- HPHT Project in GoM
- CDWOP/C-Plan Submission
- BSEE Clarifications
  - H_2S Measurement (no measurable trace)

Plan of Action

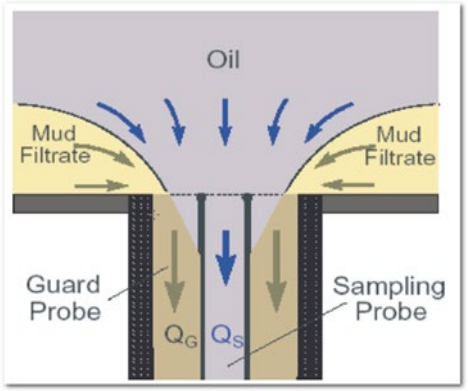


Industry Guidance/Lessons

- H_2S Scavenging
  - Drilling Mud
  - Formation Tester Tool Components
  - Pump Out Duration/Pump Out Volumes
  - Transfer of Fluids/Samples

Industry Guidance/Lessons

- Minimum Flow Path
- Alloy Coupons
- Coatings
- Contamination



Source – SPE 101084

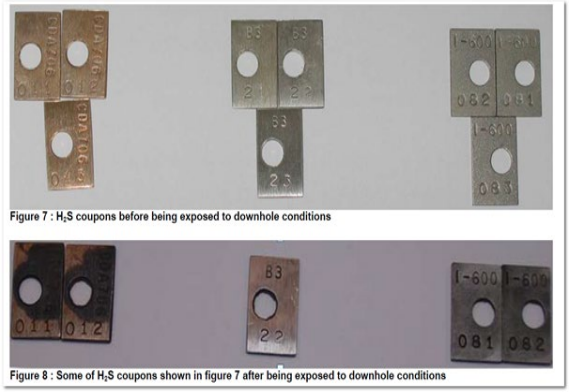
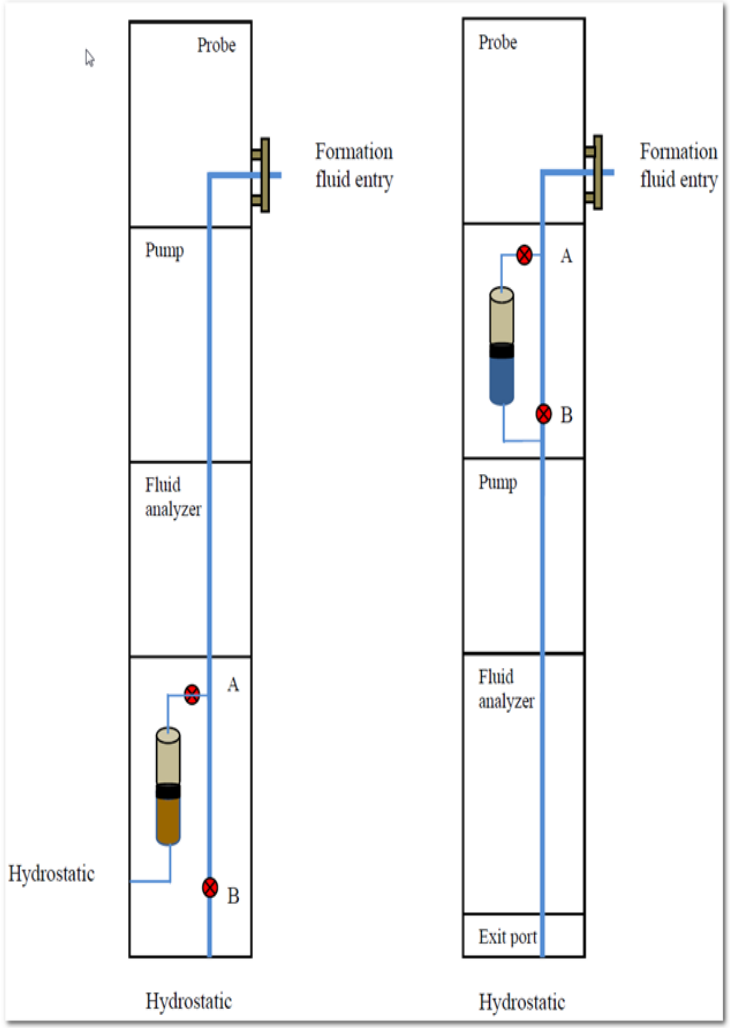


Figure 7 : H_2S coupons before being exposed to downhole conditions

Figure 8 : Some of H_2S coupons shown in figure 7 after being exposed to downhole conditions



Source – SPE 164780

Actual Job Review

- Satisfied Minimum Flow Path Requirement
- Alloy Coupons Used
- Only Coated bottles
- Drilling Mud with no H_2S scavengers

Actual Job Review

- Minimum Contamination Satisfied
- Pump Out Volumes/time - Satisfactory
- Sampling Bottles Transfer/Analysis – longer than suggested by ASTM D6228-10
- Lab Analysis - Satisfactory

Scope of Improvement

- Coating
  - Flow path
  - Latest version of coating available with better performance
- Time Gap
  - On site analysis of bottles
  - Reduce transit time for bottles

Practical Application

- Coating
  - Time constraint to coat bottles with latest version
  - Time constraint to coat on flow path
- Time Gap
  - On site analysis complicated for short notice
  - Offshore operations, difficult to reduce the transit time
  - Safety concerns for other modes of transportation

Analysis

- Lab Testing
  - Minimum amount detectable 0.5ppm (parts per million)
- Coating
  - % recovery vs hours (supplier testing)
- Time Gap
  - Avg. 44 hours for each bottle
- Pump Out Volume/Time
  - Avg. 65,188 cc and avg. 101 mins
- Coupons
  - Validation outside of absolute pressure for the job

Decision

- API 17TR8, Annex. D
- BSEE NTL. 2009 - G 31
- Engineering Judgement
  - Min. measurable amount in lab = 0.5ppm
  - Time lapsed 44 hours avg.
  - Approximate % recovery of H_2S per supplier testing 65%

Decision

API 17TR8 Annex D

Applicable GoM conditions – 50 ppm H_2S, 20,000 psi

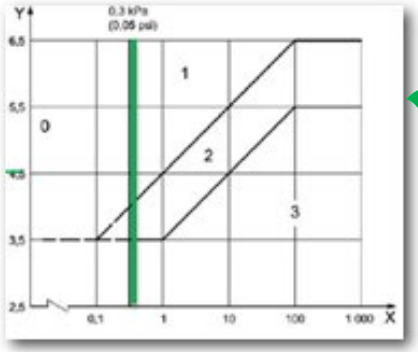
Well reservoir information conditions if available

BSEE Clarification for H_2S

NTL No. 2009-G 31

0.05 psi of Partial Pressure for H_2S

WellBore Fluid sampling studies indicated non-traceable (0 ppm) amount of H_2S.



Decision

- Based on all the research, study, review and analysis
  - 0.05 psi partial pressure of H_2S which is equivalent to 3ppm (parts per million) of H_2S was finalized
  - Case was presented to BSEE and acceptance was received on same

Acknowledgements

- Mr. Dennis Kaminski – Anadarko Petroleum Corp
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- Industry Papers – OMC 2013-177, 11582, 10622, 10624, 94707, 101084, 164780, 25014, 77771, 81495

Questions