Anti-Collision Best Practices Developed for Horizontal Drilling Across Pre-existing Horizontal Wellbores

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Anti-Collision Best Practices
presented by Erin Britton and Rachel Grande
Overview

- Current Anti-Collision Practices
- Williston Basin Overview
- Geologic Considerations and Planning
- Risk Management
- Drilling Considerations
- Stoplight Method
- Case Studies
- Conclusion
Anti-Collision

Industry View

Standard view errs towards avoidance mentality:

- Total Avoidance
- Azm. Avoidance

Limited support and documentation for alternative processes when avoidance is not an option.
Anti-Collision Case Study

Williston Basin
• 13,000 vertical wells,
• 15,000 horizontal wells,
• 1,000 re-entry/directional wells.

Developed for horizontal drilling across pre-existing horizontal wellbores in the Williston Basin.
• Drilled as close as 10 feet wellbore - wellbore
Geologic Considerations

Anti-Collision Program Constraints

- Laterally Continuous Formation
- Well Control
- Quality Data
- Clear Steering Markers
  - Gamma
  - Resistivity

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Geologic Planning
Anti-Collision Methodology

- Reinterpretation
  * Profiles
  * Structure
- Organization of Stratigraphic position
- Wellbore Placement
- Target Selection

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Drilling Considerations
Risk Management Program

Potential Risks
• Impact vs. Probability

Common Indicators
• Operational Parameters
• Geologic
• Directional/Survey
  Survey Error
  Ellipse of Uncertainty

Risk Matrix

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</tbody>
</table>

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Drilling Uncertainty
Ellipsoids of Uncertainty

Major Concern Affecting Anti-Collision Planning

• Survey Error: MWD Error and interference concerns.
  - Azimuth Uncertainty
  - Inclination Uncertainty
  - Surface Location Uncertainty

• Ellipse of Uncertainty: Expanding ellipse from surface onwards.

Netwas Group Oil, 2017
Mitigating Risk & Accounting for Error
Risk Management Meets Geology

Ability to simplify risk with the combination of drilling & geologic considerations.

- Expected Structure
- Apparent Dip
- Distinct Stratigraphic Markers

Confirmation of “Y” or TVD direction

Ellipse of uncertainty becomes plane of uncertainty with no expansion in the Y direction.
Stoplight Method
A Disciplined Approach

Multidisciplinary approach using:

- Geologic Considerations
- Operations Best Practices
- Risk Management

Geologic overlapping target windows by color zone implemented across the planned wellbore based on the risk management plan considerations.

Existing Wellbore Stratigraphic Placement

- Red: High Risk
- Orange: Med. Risk
- Yellow: Low Risk
- Green: No Risk
Stoplight Method
Risk Parameters

Red: High Risk
- Controlled Operations & “high alert” communication
- Precise Steering target required

Orange: Medium Risk
- Controlled operations and heightened communication procedures
- Overlap zone for steering adjustments

Yellow: Low Risk
- Standard operations & communication procedures
- Begin steering considerations

Green: No/Low Risk

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Drilled 32’ above existing wellbore.

23’ Total Thickness
Case Study B  
Stoplight Method

Drilled across 3 existing laterals.

- Drilled 26’ below wellbore #1.
- Drilled 34’ below wellbore #2.
- Drilled 8’ below wellbore #3.

73’ Total Thickness
Case Study C
Stoplight Method

Drilled across 3 existing laterals.

- Drilled 20’ below wellbore #1.
- Drilled 36’ below wellbore #2.
- Drilled 15’ below wellbore #3.

48’ Total Thickness
Anti-collision Moving Forward
Advancement in Practices

Mature Basin Development requires industry progression towards complex wellbore trajectories with significant collision concerns.

Williston Basin anti-collision wells historical percent:
- 2010 ~ < 0.1%
- 2016 ~ 4.25%
Conclusions

Industry Advancement

The progression towards increasingly complex wellbores requires Industry advancements in anti-collision practices and theories outside of avoidance mentality.

- Proactive approach to development for infill wells.
- Inclusive geological and engineering considerations.

The Stoplight Methodology simplifies complex multidisciplinary considerations including hazards and stringent operational requirements into easily recognizable plan.

Green = Go, Red = Stop
Thank You

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