Collision Avoidance Subcommittee Update

CA Meeting #33 18-Oct-2023
1:15 pm – 4:30 pm ~3hrs

Darren Aklestad - SLB
19 Oct 2023

SPE ACR Adoption Status / Rev 5

- 22 Attendees (2 Online) (16 companies)
- Using WPTS AC Rule - 3 (previous meeting 6)
  - Oxy
  - Chevron
  - BP (1 well)
- Using ISCWSA Rev 5 Error Model - 4
  - OXY
  - SDI
  - H&P
  - COP

Agenda Covered

1. Surface Margin – White Paper Recommendation - review and finalize
2. Guidance on Surveying Interval Recommendations for CA – RP78
3. BP Successful use of WPTS – Bill Allen
4. CA-Reporting Standardization – Minimum Information Header/Columns

WPTS Standard Collision Avoidance Separation Rule

- 2 – SPE Papers 184730/187073 (2 more mentioned)
- Validation of magnitude values for Surface Margin & Project Ahead uncertainty – guidance

$$SF = \frac{D - R_r - R_o - S_m}{k\sqrt{\sigma_s^2 + \sigma_{pa}^2}}$$

$$k = 3.5,\ S_m = 0.3\text{m and } \sigma_{pa} = 0.5\text{m}.$$

$$SF = \frac{D - R_r - R_o - 0.3}{3.5\sqrt{\sigma_s^2 + 0.25}}$$

What is Sm and Pa? Why are they there?

- Sm – Surface Margin
  - To account for lack of any initial positioning uncertainty but enforce requiring added spacing to account for the space needed for initial EOU growth

$$SF = \frac{D - R_r - R_o - S_m}{k\sqrt{\sigma_s^2 + \sigma_{pa}^2}}$$

$$SF = \frac{D - R_r - R_o - S_m}{k\sqrt{\sigma_s^2 + \sigma_{pa}^2}}$$

- Pa – Project Ahead
  - Added uncertainty to account for the un-surveyed distance ahead of the last surveyed position.

Surface Margin – Issue

- Problem with WPTS?
  - Near surface less space to drill. Resistance to rule adoption. Wells already drilled now fail.
  - Further down more space – no complaints!
- Why?
  - Sm is included as additional space deduction in SF numerator. When close this is an additional ~1ft reduction which may be a significant proportion of available space – influence fades away as more separation attained
  - Previous surface handling was through a **separate** rule / not an additive rule

White Paper Addendum to WPTS Rule

- Work for Sm / Pa validation - Jerry Codling (Halliburton/Landmark)
  - Preceding 2~3 meetings presented previous surface CA handling methods
  - Presented validation of the magnitudes of the parameters (previous derivation (where did they come from) seemed to have been forgotten)
  - White Paper prepared (Action item from meeting #32 9-Mar-2023)
- Expected to allow continued use of existing surface handling rules (rather) than Sm parameter

Discussion

- Lively discussion for over an hour …. over Sm ~1 ft
- Re-hashed the details
- Reminded of need for risk assessment
- Reminded to not be swayed by desired outcome
- Reminded previous practice success not an absolute indication of correctness (we didn't hit wells before….. or did we?)
- Reminded some practices probably were not as safe as they could be
- Minimum slot spacing to just touch ~6ft (New platforms should be built bigger)

WPTS Collision Rule – Committee Recommendation

- WPTS Rule is accepted (re-re-analyzed) as correct and appropriate
- The published values of Sm & Pa are also accepted as appropriate
- The WPTS rule should be the primary rule used
- If WPTS rule fails and with further investigation of specific drilling circumstances – a modified version can be employed
  - The Sm & Pa constants may be adjusted as needed for specific drilling circumstances – even to zero.
  - Re-use of previous separate surface rule may be appropriate – only after specific situation investigation another means of accounting for surface collision avoidance mitigation
- White paper will be published on the website as an addendum to the rule
- Possible update concerning Pa – work ongoing (Marc Willerth H&P)

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CA Survey Interval – SPE-184730 Well Collision Avoidance Management Principles

Surveying Interval. The following recommendations for the maximum survey interval are intended only for safe-separation and collision avoidance, Table 3. They do not address the requirements for routine drilling and meeting other well objectives such as targets. To be valid, all surveys are required to pass the quality control criteria appropriate to the survey tools and the applied IPMs. In general, the survey frequency increases with increasing dog-leg severity (DLS) and decreasing SF. The intervals may be adjusted for non-standard tool joints or stands (Double, Triple, Quad and Range I, II, III). The intervals may also be extended where the continued divergence of the reference well from all the offset wells has been firmly established.

Table 3—Recommended maximum survey interval for safe-separation and collision avoidance

Maximum Survey Interval [ft]		DLS [deg/100ft MD]		
		<1	1 – 5	>5
SF [-]	>2	200	100	33
	1.5 – 2	100	100	33
	<1.5	33	33	33

Surveying Interval Recommendation – Issue

- What is wrong with the published table?
  - Seems to require far too much time surveying
  - Technical cleanup issues e.g. no units no metric equivalent
  - Not specific enough to address intervals needing surveying at higher frequency

Table as Discussed – revised from previous meeting

Table 8—Recommended Maximum Survey Interval for Safe Separation and Collision Avoidance

Separation Factor (SF)	Planned DLS [°/100 ft MD]		
	DLS ≤ 2°/100 ft DLS ≤ 2°/30m Very Long Radius / Tangent Interval	**2° < DLS ≤ 6°/100 ft 2° < DLS ≤ 6°/30m Long Radius / Steered Interval**	**DLS > 6°/100 ft DLS > 6°/30m Medium Radius / Steered Interval**
MRSI w/ given directional drilling action without collision avoidance	140 ft (42 m)	100 ft (30 m)	100 ft (30 m)
SF > 4.0	Follow Regulatory Requirements (FRR)		
1.5 < SF ≤ 4.0	200 ft (60 m) or FFR	100 ft (30 m)	100 ft (30 m)
SF ≤ 1.5	140 ft (42 m)	100 ft (30 m)	45 ft (14 m) or DP joint length

Discussion

- Noted discrepancies between with or without collision risk
- With or without regulatory requirements and less restrictive
- Closed a loophole that could be abused
- Discussed if this is Planned DLS or yield of drilling system capability
- Jonathan Lightfoot (Oxy) made immediate updates

Survey Interval Table - Revised Comparison

Before

Table 8—Recommended Maximum Survey Interval for Safe Separation and Collision Avoidance

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1.5 < SF ≤ 4.0	200 ft (60 m) or FRR	100 ft (30 m)	100 ft (30 m)
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After

Separation Factor (SF)	Planned Steering Yield or Expected Dogleg Severity (DLS) [°/100 ft MD]		
	DLS ≤ 2°/100 ft DLS ≤ 2°/30m Very Long Radius / Tangent Interval	2° < DLS ≤ 6°/100 ft 2° < DLS ≤ 6°/30m Long Radius / Steered Interval	DLS > 6°/100 ft DLS > 6°/30m Medium Radius / Steered Interval
SF > 4.0	200 ft (60 m)	100 ft (30 m)	100 ft (30 m)
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Note: The preceding table is intended as general guidance for determining survey intervals that ought not exceed minimum regulatory requirements for spacing between surveys for vertical, directional, and horizontal wells. As additional wellbores may be added in the future, it is also recommended that exploration wells and other stand-alone wells adhere to these guidelines.

Final Revised Table Recommendation & RP78 Inclusion

Separation Factor (SF)	Planned Steering Yield or Expected Dogleg Severity (DLS) [°/100 ft MD]		
	DLS ≤ 2°/100 ft DLS ≤ 2°/30m Very Long Radius / Tangent Interval	2° < DLS ≤ 6°/100 ft 2° < DLS ≤ 6°/30m Long Radius / Steered Interval	DLS > 6°/100 ft DLS > 6°/30m Medium Radius / Steered Interval
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Successful Use of WPTS Rule - Experience

- Bill Allen (BP) discussion no presentation
- Isolated deployment
- Update to Rev5 toolcodes
- Observed the same WPTS rule and Rev 5 results/behaviors as reported by others
- Ongoing efforts required for widescale deployment

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Collision Avoidance Reporting - Standardization

- Previous meeting (56/31 Houston / 57/32 Stavanger) Defined 13 Columns & Header items
- This meeting (58/33) added some minimal header additions
  - May need more explicit details on probability of collision
- Expansion to include EOU reporting minimum columns
  - Support output or Inc/Az uncertainty for QA/QC qualification through Chi2 and RIP testing
- Ensure lexicon has appropriate definitions for standardized equations
- Additions to account for “Relative” uncertainty via Rev5 update

CA Reporting Nomenclature Standardization

#	Full Description of Column	Name	Short Name	Value Type
1	Reference Well Measured Depth	Reference MD	Ref MD	length / distance
2	Reference Well True Vertical Depth	Reference TVD	Ref TVD	length / distance
3	Offset Well Measured Depth	Offset MD	Off MD	length / distance
4	Offset Well True Vertical Depth	Offset TVD	Off TVD	length / distance
5	Centerline to Centerline Wellbore Proximity	Ct-to-Ct Distance	C-C	length / distance
6	Minimum Acceptable Separation Distance required to satisfy Collision Avoidance Rule	Minimum Allowable Separation Distance	MASD	length / distance
7	Separation Factor	Separation Factor	SF	unitless
8	Travelling Cylinder North Azimuth	Travelling Cylinder North Azimuth	TC Azi.	angle
9	Normal Plane Distance (Traveling Cylinder Plane)	Normal Plane Distance	TC Dist.	length / distance
10	Allowable Distance from Reference Well that will satisfy Collision Avoidance Rule	Allowable Deviation From Reference	ADR	length / distance
11	Orientation of Closest Approach relative to Reference Well's direction (Ahead/Behind)	Closest Approach Orientation	Ang	boolean (ahead/behind)
12	Collision Avoidance Rule Status (Pass/Fail)	CRA Status	Status	boolean
13	Collision Avoidance Action Criteria	Collision Avoidance Action	Action	free text
14	Active Rule	Active Rule		text
15	Probability Of Collision			

Agenda Items – NOT Covered

5. Update CA Benchmark for Rev5 & WPTS
6. Sidetrack handling - Benchmark
7. CA-Survey Database Management - *new* Recommendations
8. Probability of Collision resurrection? Recommendations?

Continued Working

1. Update Documentation – Bibliography / Lexicon / Merge include other groups
2. Complete reporting minimum standards
3. Sidetrack handling CA diagnostics files and Rev 5 update of benchmarks
4. Update CA Benchmark for Rev5 & WPTS
5. Update of details of CA test wells
6. Inferred Wellbore Position – a committee formed (Pete Clark)

New Initiatives

- Probability of Collision resurrection? Recommendations?
  - Survey of current landscape
- CA-Survey Database Management (Hans Dreisig - TotalEnergies)
  - Expansion with details of other components of competent CA system
- Recommendations on Graphics systems for CA and combined covariance representation

Thank You – Questions? Corrections?