Improving AC Barriers

SPE WPTS / ISCWSA AC Subcommittee
Oct 6 & 7, 2021

Virtual Session

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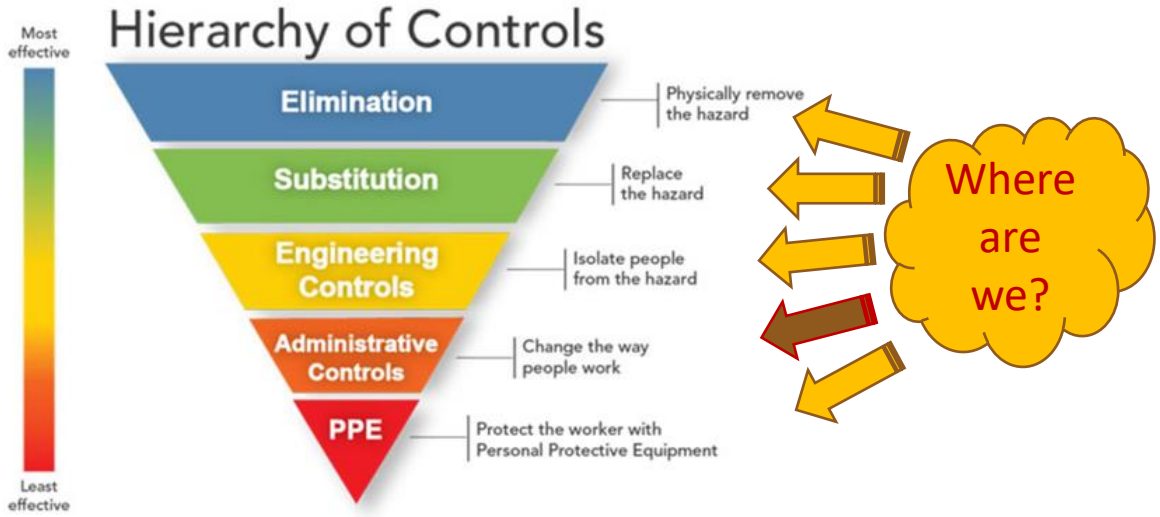
Observations – Collision Events

- A well collision event in this presentation is defined as an event where the drilling team compromises a separation rule created to prevent a wellbore collision
- A common opinion is that very few, if any, collision related incidents are due to inadequate survey tool models or separation rules
- Collision event findings indicate procedural discipline, human factors and a limited workforce understanding of well placement error sources and consequences

Current approach?

- Require written procedures to deliver well placement tasks from planning and well execution/drilling to post job data review and archive
- Require a common set of separation rules and survey system performance models (aka error models)
- Require minimum team capability
- Generate North Referenced TC plots (*paper*) for deployment to rig teams and remote office monitoring teams to be **updated by hand** (with aide of software)
- Onshore & Offshore teams compare results after each survey with a projected position no less than the next bit position at stand down.

Review: The hierarchy of controls



The idea behind this hierarchy is that the control methods at the top of graphic are potentially more effective and protective than those at the bottom. Following this hierarchy normally leads to the implementation of inherently safer systems, where the risk of illness or injury has been substantially reduced.

2021 AC Barrier Objectives
create a digital (autonomous) system to;

- Detect
  - Acquire information
- Decide
  - Classify safe, unsafe, trend
- Deflect
  - Stop, Steer, continue

- Be auditable
  - Permit SV&OS, Audit & Assurance
- Be simple & intuitive
  - Simple but not simplistic
  - Readily accessible to key stakeholders
- Be flexible e.g. easy BP (*industry*) adoption
  - Not limited to BP requirements
  - Not limited by Rig/Directional Suppliers
- Be RELIABLE - uptime
- Be Secure
- Be Predictable – work as intended always

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More to come… Fall 2021

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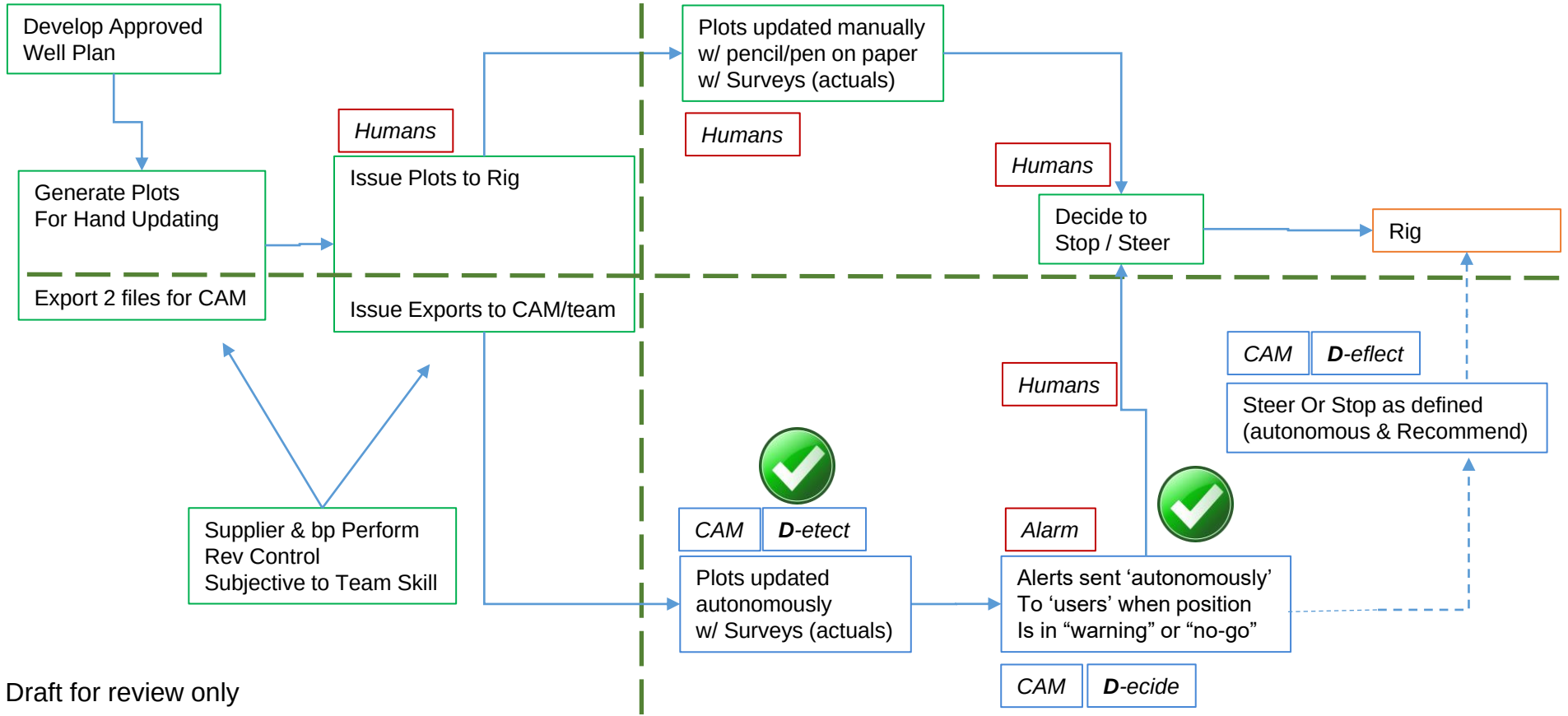

Draft for review only

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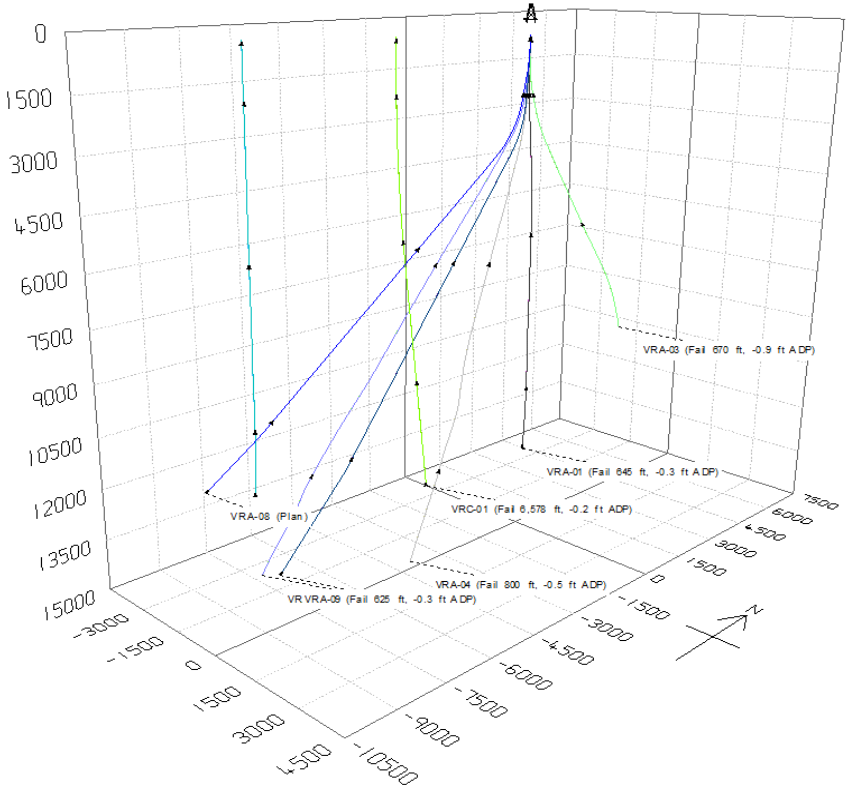

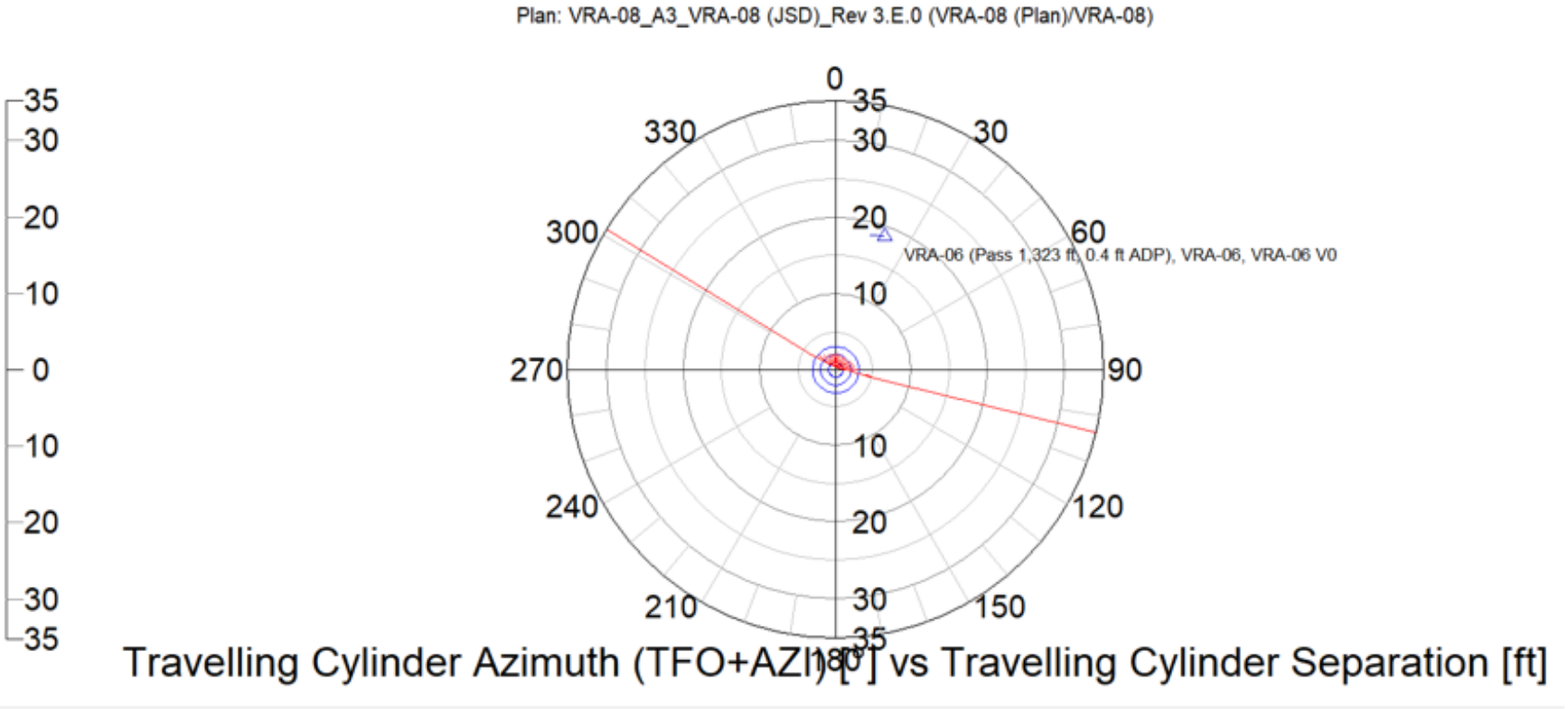

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    - SPE/IADC 184730, p12
    - SPE 187073
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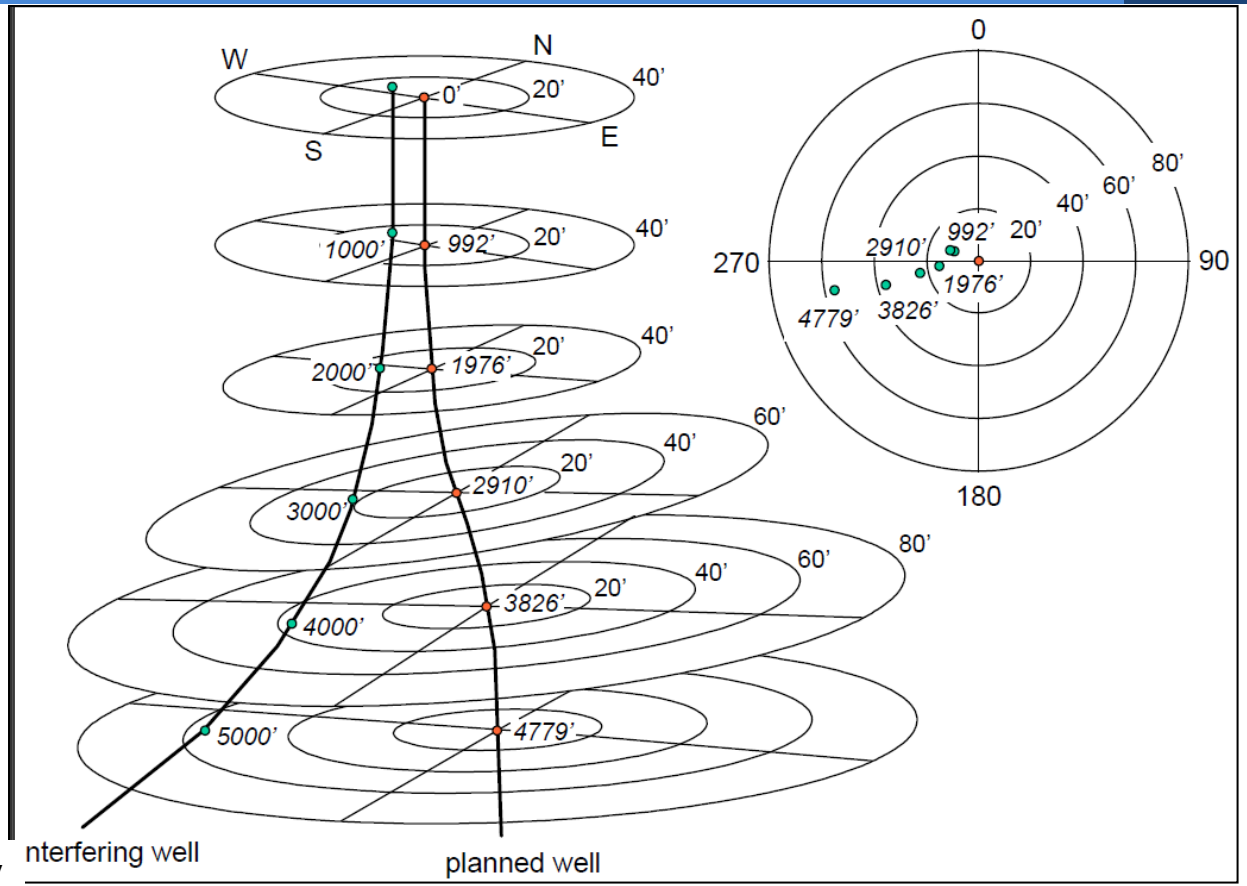
"…It is Recommended that the north-referenced, normal plane travelling cylinder diagram (Thorogood and Sawaryn, 1991) be used…"
SPE/IADC 184730

"… used to monitor progress, project ahead and assess closure between wells… an important communications aid for achieving common situation awareness between all stakeholders."
SPE 187073



Visualize Actual vs. Plan position

- Plan is 45 Inc, heading 60 Az at the depth of interest. The as-drilled projected bit position (at depth) is the green dot below

Using the matrix below, identify where we are relative to our plan

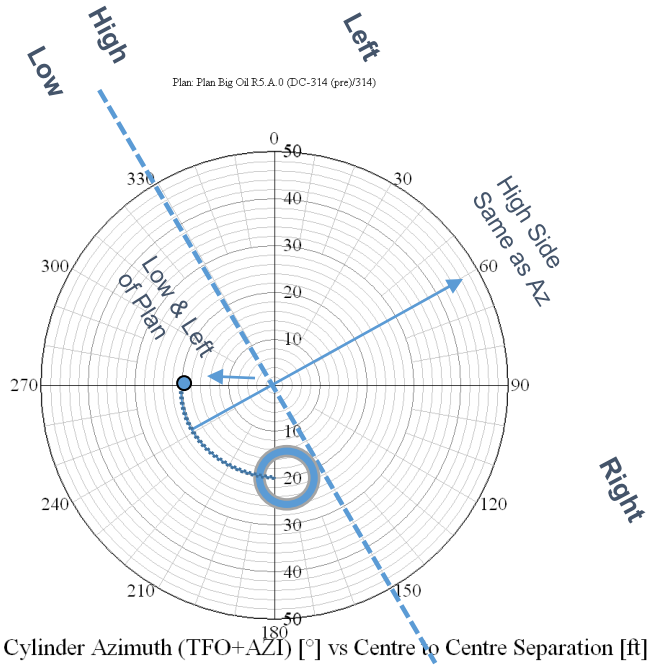
H Left	High	H Right
Left	On plan	Right
L Left	Low	L Right

50 40 30 20 10 0 10 20 30 40 50

How far 'off plan' are we 20 (ft)?

What position from plan (use matrix above)

Mouse click for answers

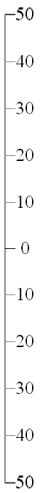


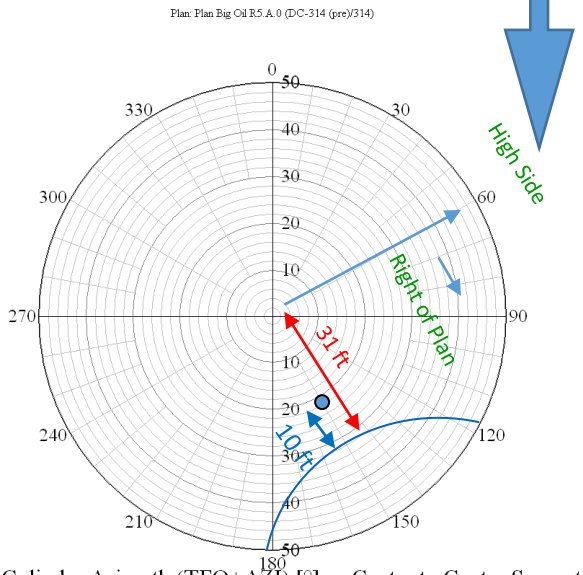
Visualize Actual vs. Plan position

- Plan is 45 Inc, 60 Az at depth of interest.

The as drilled position is on radial 150, 21 feet from TC plot origin

H Left	High	H Right
NW	North	NE
Left	On plan	Right
West		East
L Left	Low	L Right
SW	South	SE





Travelling Cylinder Azimuth (TFO+AZI) [°] vs Centre to Centre Separation [ft]

What is the direction & distance to the Tolerance line from plan? Right & 31 feet away

What is the allowable deviation from our as-drilled point? ~10 feet

To steer towards plan, we would steer in what direction (refer to matrix above)? Left

Mouse click once for each answer

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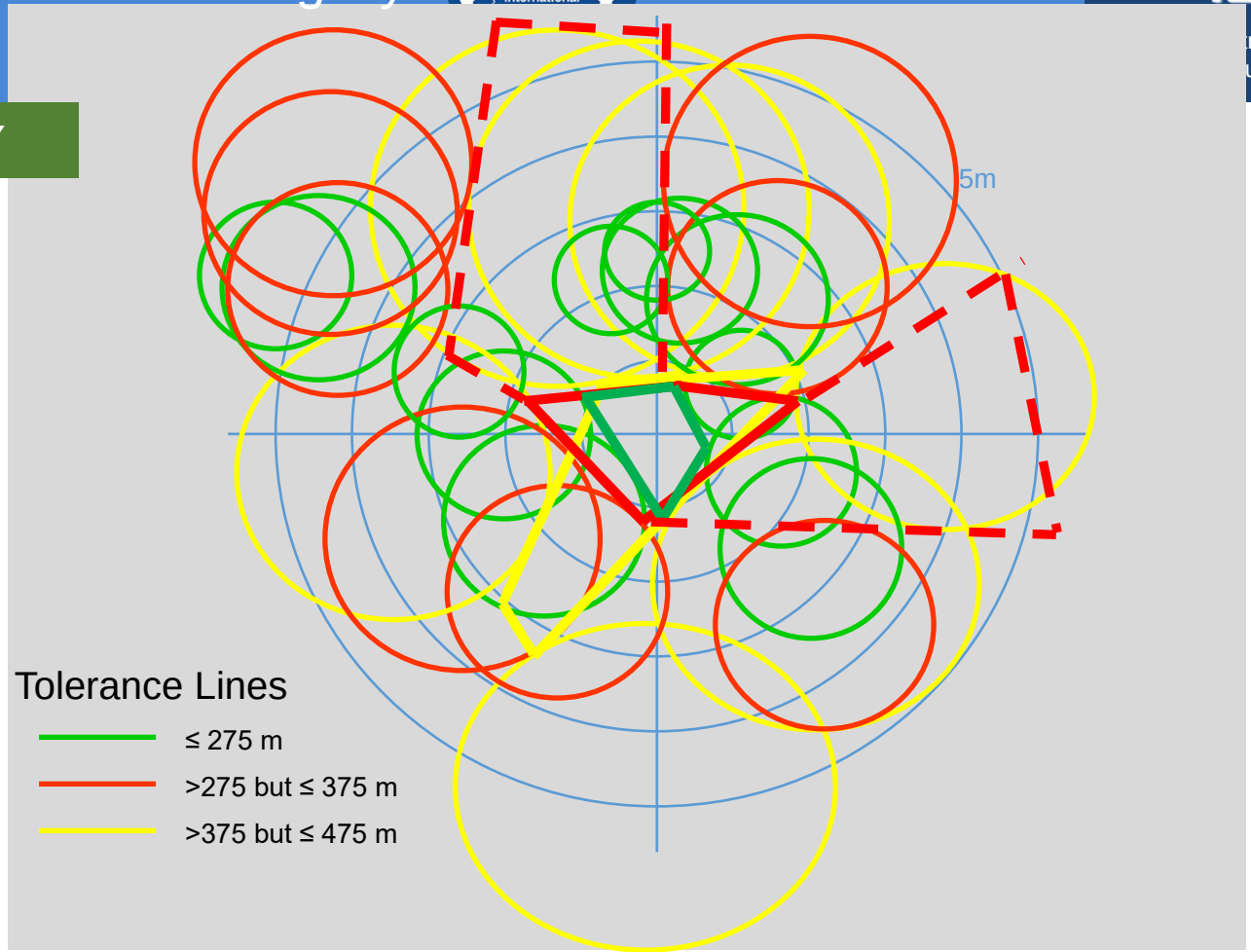
Travelling Cylinder Tolerance Lines

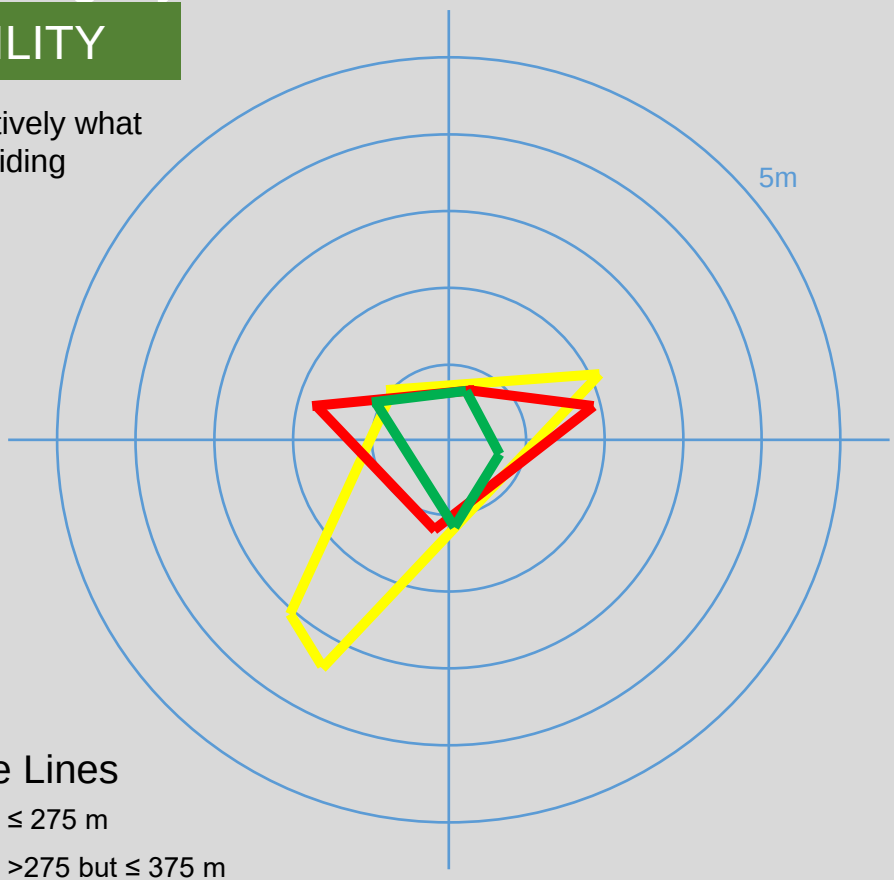
USABILITY



Travelling Cylinder Tolerance Lines

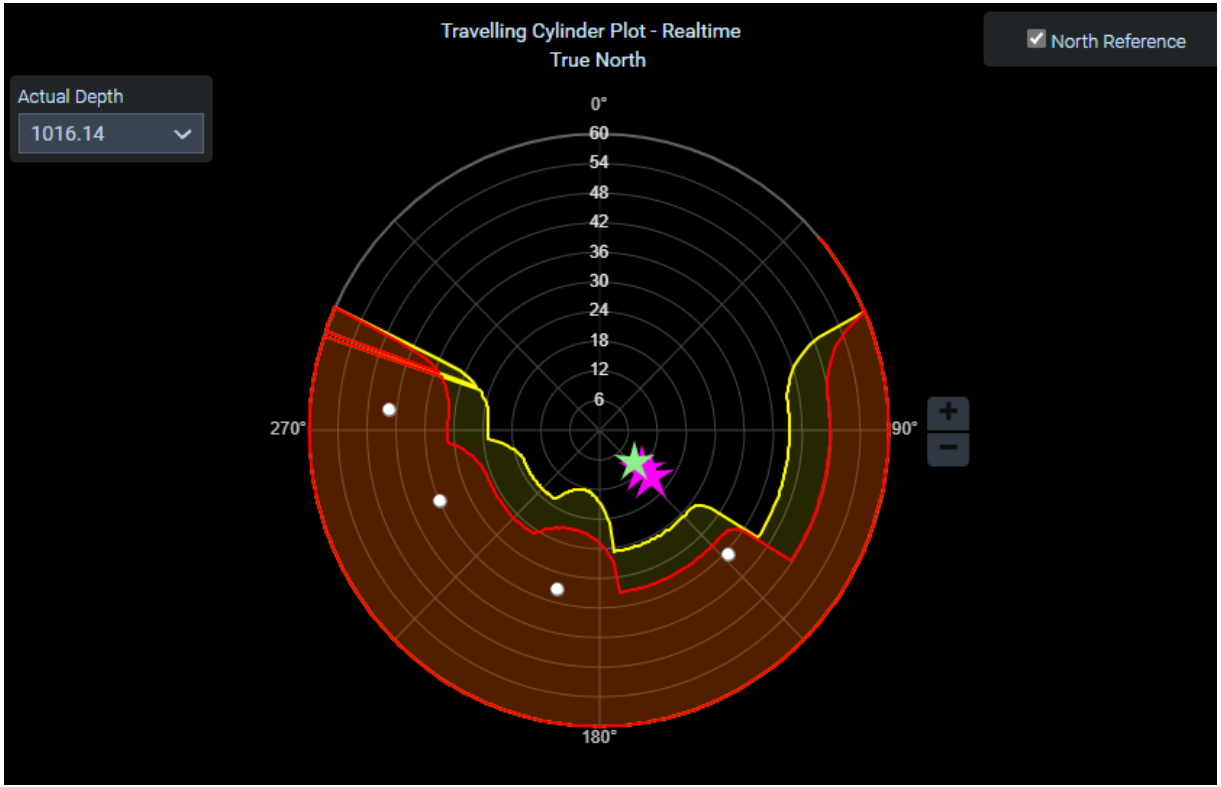
USABILITY

This is effectively what **CAM** is providing



Tolerance Lines

- ≤ 275 m
- >275 but ≤ 375 m
- >375 but ≤ 475 m


Travelling Cylinder Plot - Realtime
True North
North Reference
Actual Depth
1016.14
0°
60
54
48
42
36
30
24
18
12
6
270°
90°
180°

Working with the Alarm

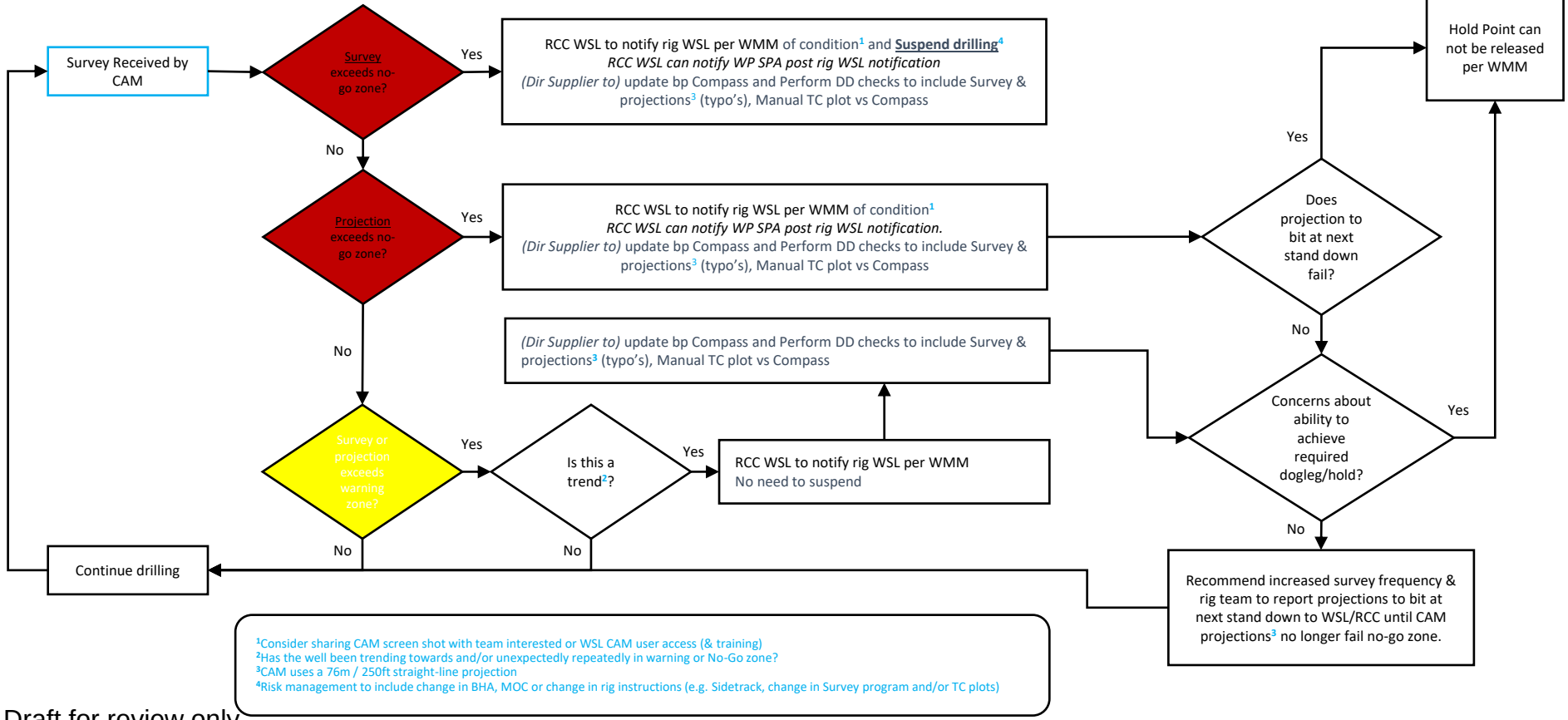
Back to Humans

for now…

Escalation Protocol Option B rev4

Wellbore Positioning Technical Section

Steering Committee on Wellbore Survey Accuracy (ISCWSA)



[1]Consider sharing CAM screen shot with team interested or WSL CAM user access (& training)
[2]Has the well been trending towards and/or unexpectedly repeatedly in warning or No-Go zone?
[3]CAM uses a 76m / 250ft straight-line projection
[4]Risk management to include change in BHA, MOC or change in rig instructions (e.g. Sidetrack, change in Survey program and/or TC plots)

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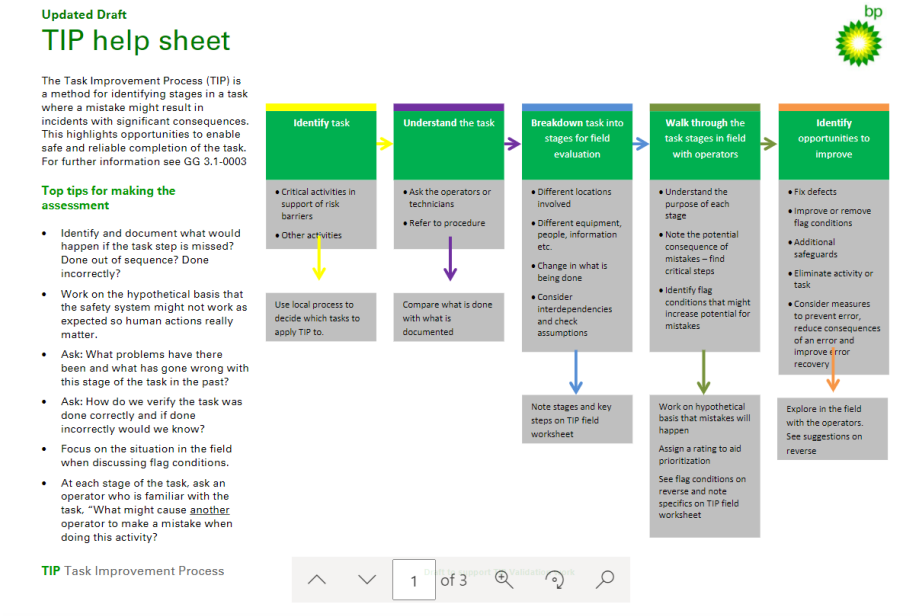
So What's Next? TIP

- Is the NEW process delivering as promised?
  - Safer?
  - Simpler?
  - Working as intended?
    - Do people who designed the process understand how work is really done? Is it different?
  - Understood by target users/stakeholders?

TIP

Task Improvement Process



Updated Draft

TIP help sheet

bp

The Task Improvement Process (TIP) is a method for identifying stages in a task where a mistake might result in incidents with significant consequences. This highlights opportunities to enable safe and reliable completion of the task. For further information see GG 3.1-0003

Top tips for making the assessment

- Identify and document what would happen if the task step is missed? Done out of sequence? Done incorrectly?
- Work on the hypothetical basis that the safety system might not work as expected so human actions really matter.
- Ask: What problems have there been and what has gone wrong with this stage of the task in the past?
- Ask: How do we verify the task was done correctly and if done incorrectly would we know?
- Focus on the situation in the field when discussing flag conditions.
- At each stage of the task, ask an operator who is familiar with the task, "What might cause another operator to make a mistake when doing this activity?

TIP Task Improvement Process

Identify task	Understand the task	Breakdown task into stages for field evaluation	Walk through the task stages in field with operators	Identify opportunities to improve
• Critical activities in support of risk barriers • Other activities	• Ask the operators or technicians • Refer to procedure	• Different locations involved • Different equipment, people, information etc. • Change in what is being done • Consider interdependencies and check assumptions	• Understand the purpose of each stage • Note the potential consequence of mistakes – find critical steps • Identify flag conditions that might increase potential for mistakes	• Fix defects • Improve or remove flag conditions • Additional safeguards • Eliminate activity or task • Consider measures to prevent error, reduce consequences of an error and improve error recovery
Use local process to decide which tasks to apply TIP to.	Compare what is done with what is documented	Note stages and key steps on TIP field worksheet	Work on hypothetical basis that mistakes will happen Assign a rating to aid prioritization See flag conditions on reverse and note specifics on TIP field worksheet	Explore in the field with the operators. See suggestions on reverse

1 of 3

Unexpected Challenges

- Data Movement
  - Digital Security (Cloud/Firewalls/DMZ's/Rig…)
  - Governmental & Regulatory Compliance
- Compensation Model/Template (don't laugh!)
- Process to permit Collaborative Environment re: Setup, SV, Execute, Archive
  - So many options/tools?

Questions?