Slugging Reduction and Production Enhancement by Emulsion Breaker Injection in Gas Lifted Wells.

Ekofisk Case.

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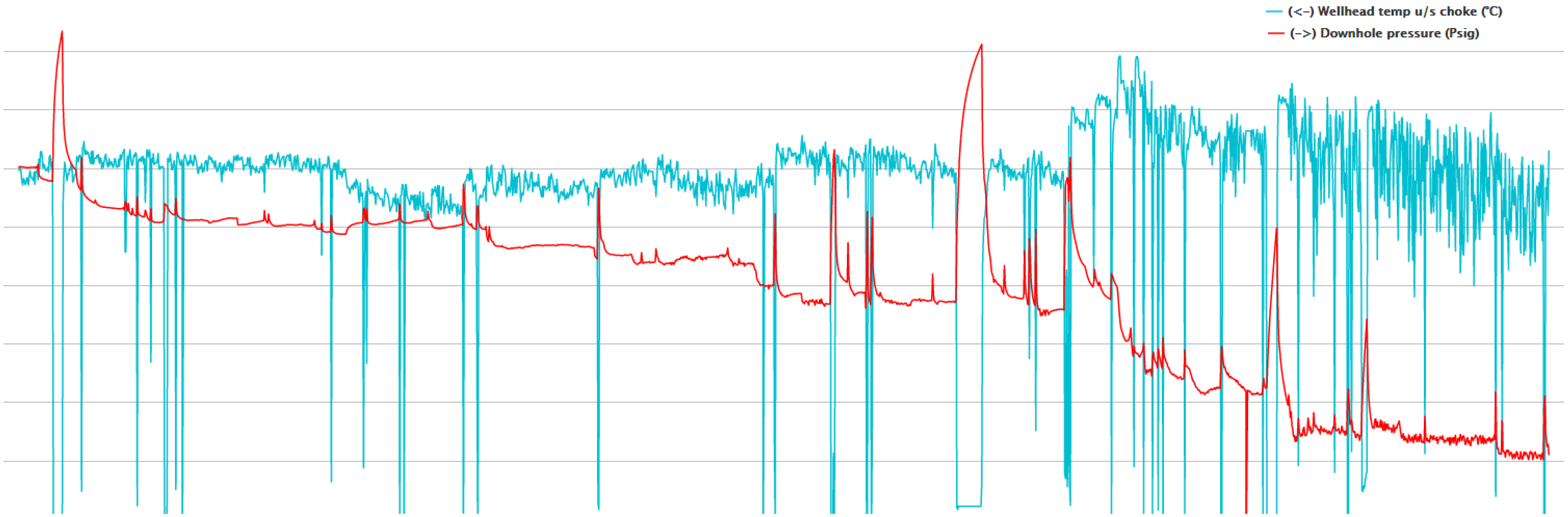
Problem statement

- Most of GEA wells over the time start to produce at low bottom hole, become heavy and hence start slugging
- Slugging leads to extensive fluctuations in process facilities which has negative impact at separation, instrument control, oil metering, etc.
- Slugging can have a negative impact at production

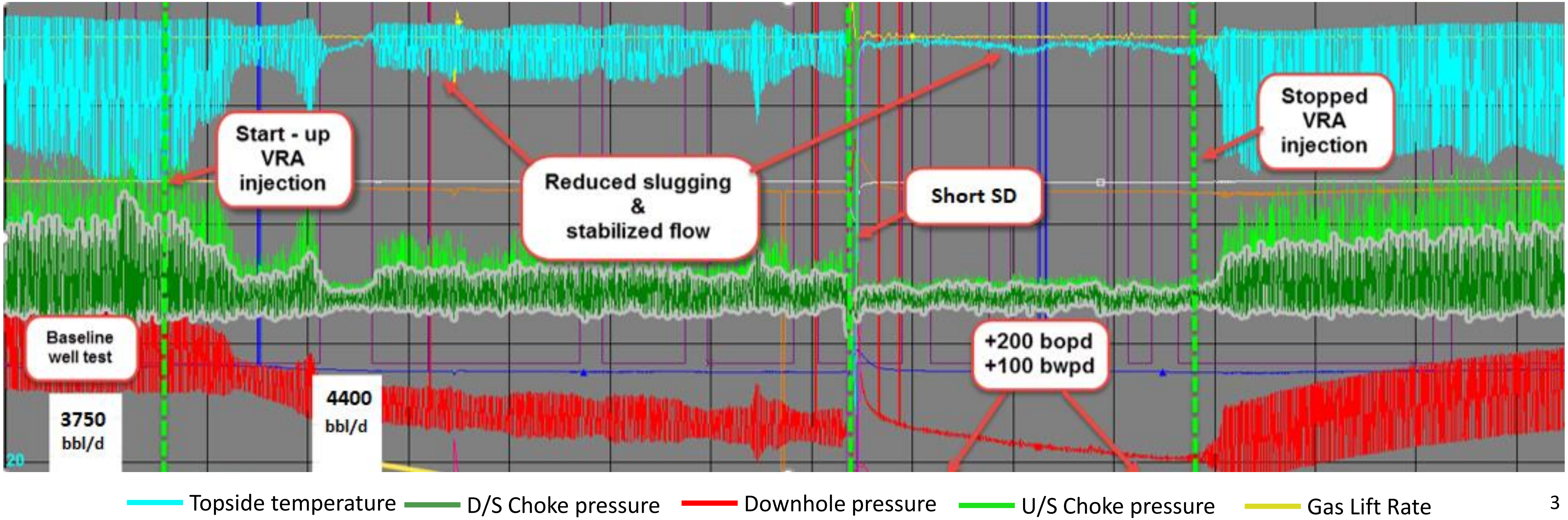
Fig. 1. Example of slugging development over time



Solution

- Slugging can be improved by application of emulsion breaker injection in gas lift system
- Reduced viscosity gives less pressure drop across the tubing and hence well shows more stable flow
- VRA – Viscosity Reducing Agent

Fig. 2. Example of VRA impact at well slugging



Project History	
Pilot 1 **2016**	Evaluated applicability and identified potential candidates for the trial Performed Pilot 1. Proof of concept obtained. **Tech worked, but was not applicable for all wells** (25% success)
Pilot 2 **2017-2018**	Developed simulation model for screening of the new candidates Completed well integrity impact evaluation Performed 10 days field trial – “Pilot 2” at 7 Ekofisk wells **Observed sustained slugging reduction & variable production uplift with higher success rate (70%)** Recommended to test all wells prior to permanent implementation
Pilot 3 **2019-2020**	Developed semi-permanent testing facility design Performed environmental impact evaluation and obtained NEA permission **Started Pilot 3 Nov. 2020**

Slugging	After EB injection in gas lift
	

Pilot 2 Production overview

	Δ Oil, bopd	Δ Water, bwpd	Δ Total Liquid %	Water Cut Prior %	Water Cut After %
Well 1	-4	+187	+5.5	88.6	90
Well 2	+28	+ 238	+7.4	87.5	87.6
Well 3	+16	+80	+4.2	93.3	92.9
Well 4	+132	+55	+5.5	70.0	67.8
Well 5	+213	+82	+7.8	77.3	73.7
Sum	+385	+ 642	4-8	-	-

Sensitivity to concentration

- Wells showed immediate response to EB injection in gas lift
- Production uplift was impacted by initial flush
- Uplift was sensitive to chemical concentration

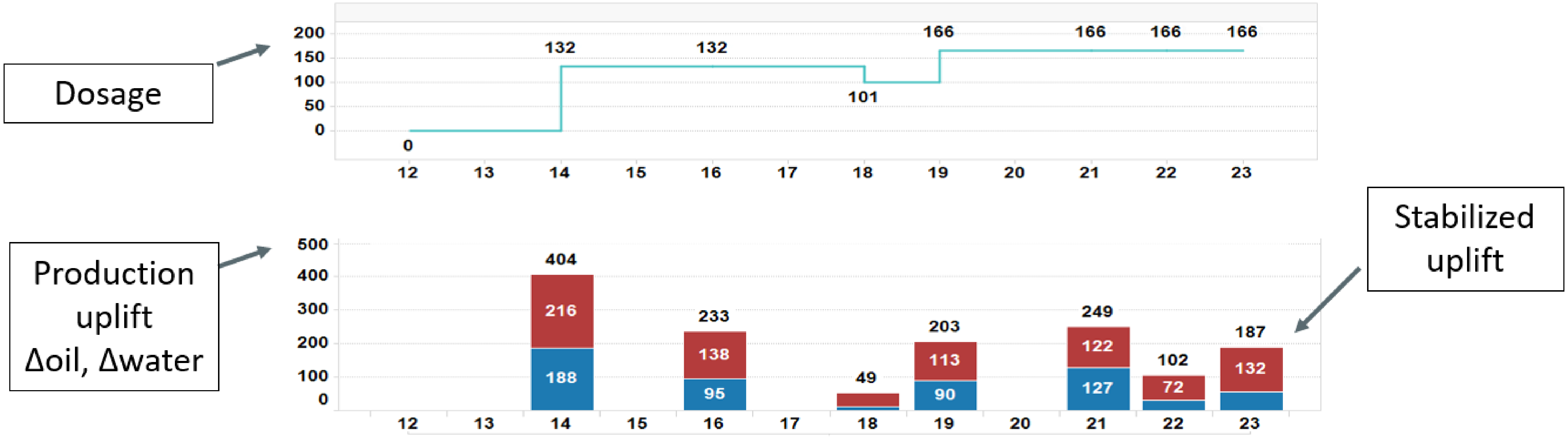
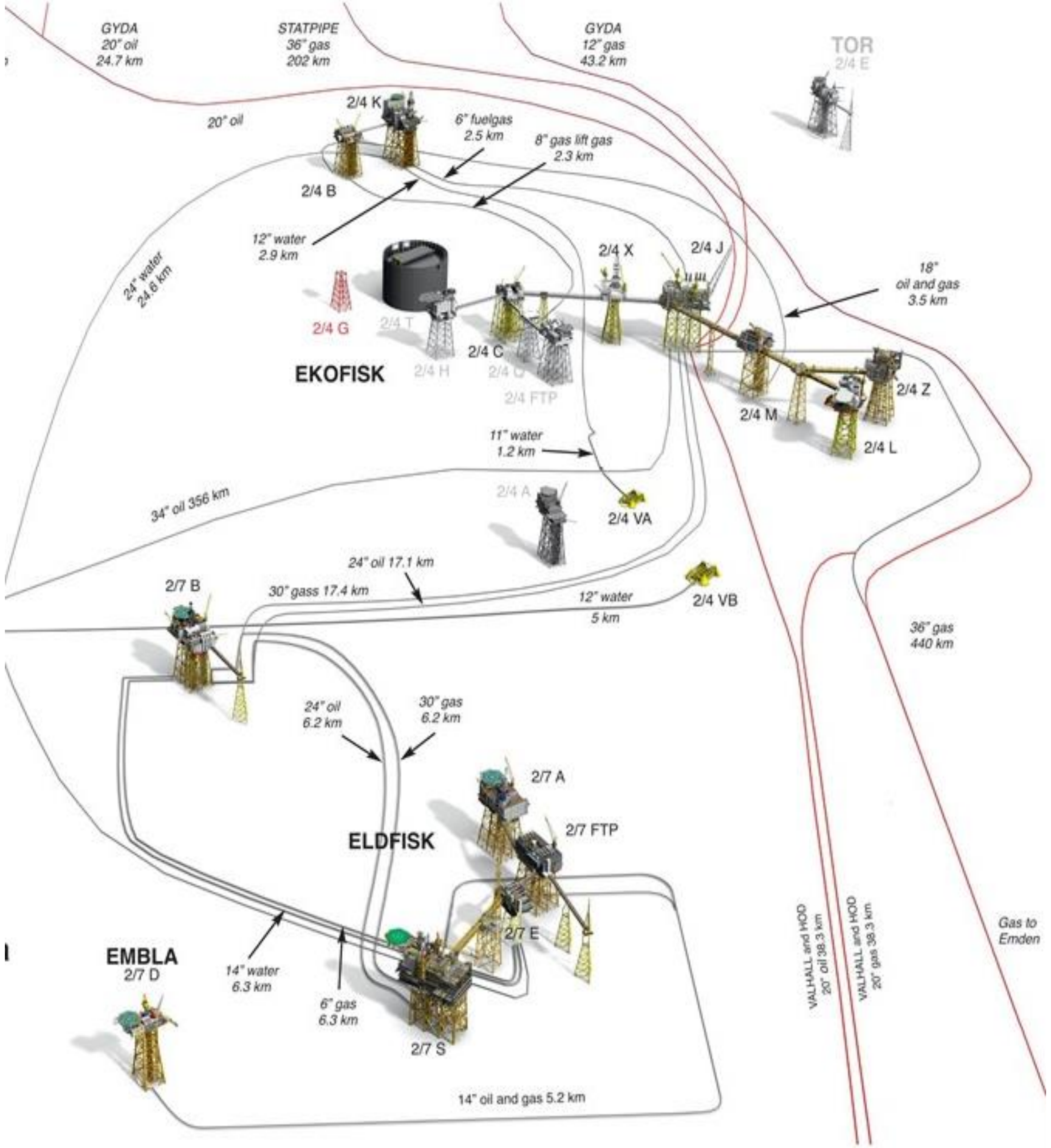


Fig. 3. Sensitivity of chemical dosage

PILOT 3 scope

- Plan is to test EB injection for **all gas lifted wells at all GEA production platforms**
- Injection in up to 4-6 wells at the same time per platform
- After 5 days of injection, decision will be taken to continue or to stop VRA injection in particular well based on observed impact
- If VRA effect will be observed - injection in particular well will be continued & stopped after 3 months
- **Goal is to quantify production uplift & define number of wells which will be included in business case for permanent implementation** (uplift vs OPEX cost of permanent injection)



Conclusions

- Emulsion breaker injection in gas lift is a **successful technique but is not applicable for all wells** and the candidate selection method is critical
- In the two trials, sustained slugging reduction and variable production uplift was observed in some wells: 25% of wells in the first pilot and 70% of wells in the second pilot
- Where successful, **4-8% liquid uplift** was achieved
  - Low oil uplift for high water cut wells
  - Didn’t result in any change in production or slugging on low water cut wells
- No well integrity or performance of topside process systems issues were observed during either trial as determined in the pretrial assessment
- **Plan is to test technology on all gas lifted wells** in order to quantify production uplift & define number of wells which will be included in business case for permanent implementation

Questions?