



DOSAGE OPTIMIZATION BY HOLLISTIC WAX MANAGEMENT APPROACH TO ENSURE FLOWABILITY OF WAXY CRUDE OIL

Pertamina Gas Operation Rokan Area – Operation West Region



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EXPERIENCE & EXPOSURE

1. 13 Years of Experience in Natural Gas and Crude Oil Pipe
2. Operation Task Force Team for Senipah – Balikpapan Gas Pipeline (2023-2024)
3. Operation Task Force Team for Rokan Crude Pipeline (2021-2022)
4. Innovation Program Coach
5. Certified Risk Professional & Life Cycle Assessment

PUBLICATION & PATENT

1. **Enhancing Complex Waxy and Asphaltic Crude Oil Flowability by Holistic Wax Management Approach in Sumatera Field** – Poster Session Society Petroleum Engineer (SPE) Workshop at Kuala Lumpur 2025
2. **Overcoming Challenges of Crude Oil Commissioning Transmission Line Segment 4 Kota Batak** – Seminar Nasional Keinsinyuran FT UGM 2025
3. **Metode Pemasangan Membran pada Kolam Penampung Air di Stasiun Kompresor Gas** – Patent IDS006358 2023

PERTAMINA GAS BUSINESS

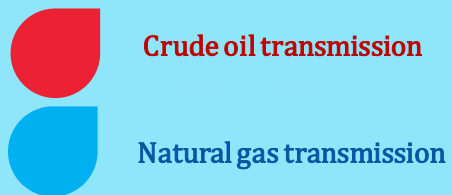


CRUDE OIL TRANSPORTATION

±605 km
Pipeline Length

±163,000 BOPD
Crude Oil Transportation

27% NATIONAL
PRODUCTION



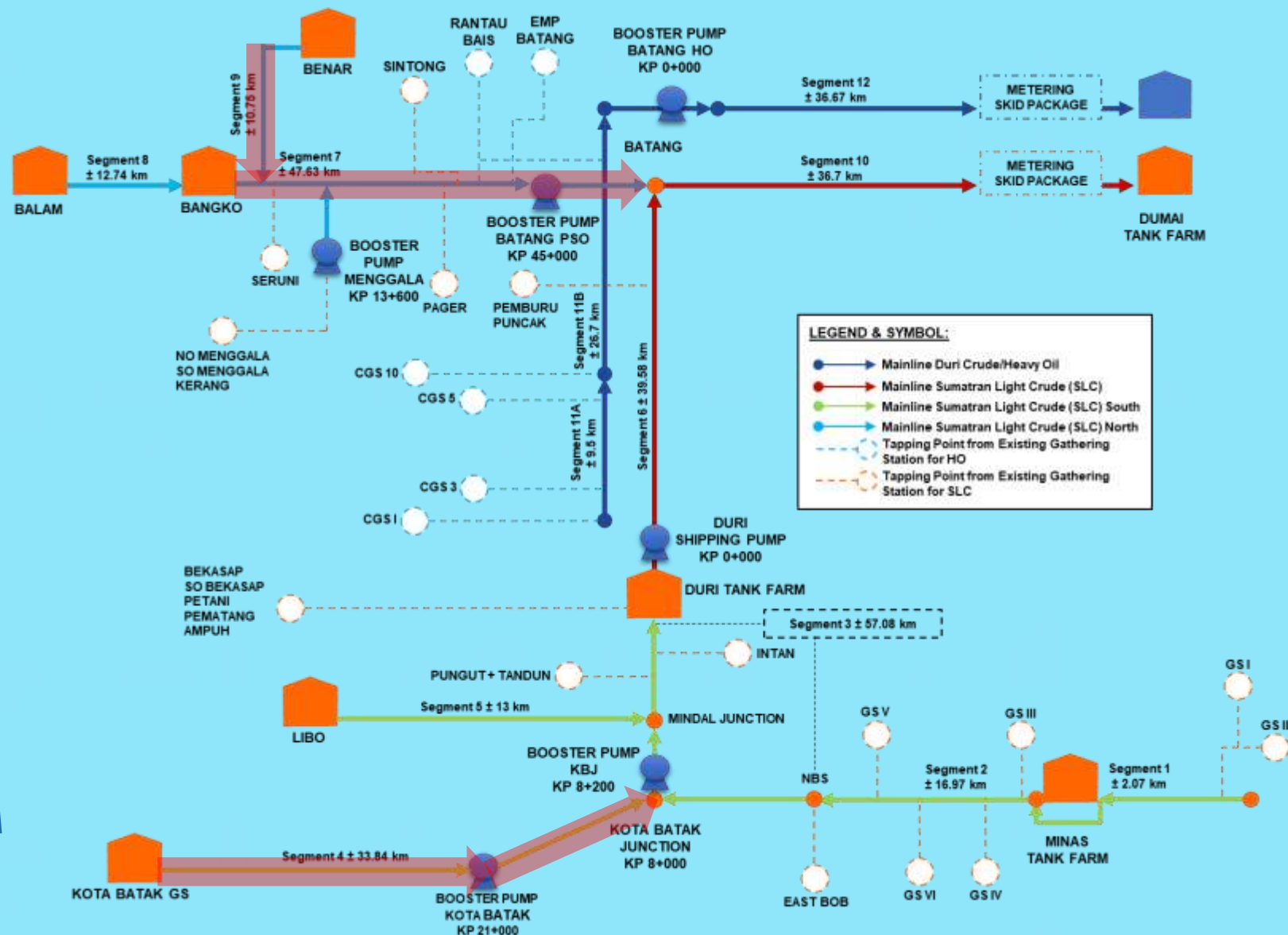
CRUDE OIL TRANSMISSION – FIELD ROKAN

High Risk
pipeline operation

Complex
pipeline network

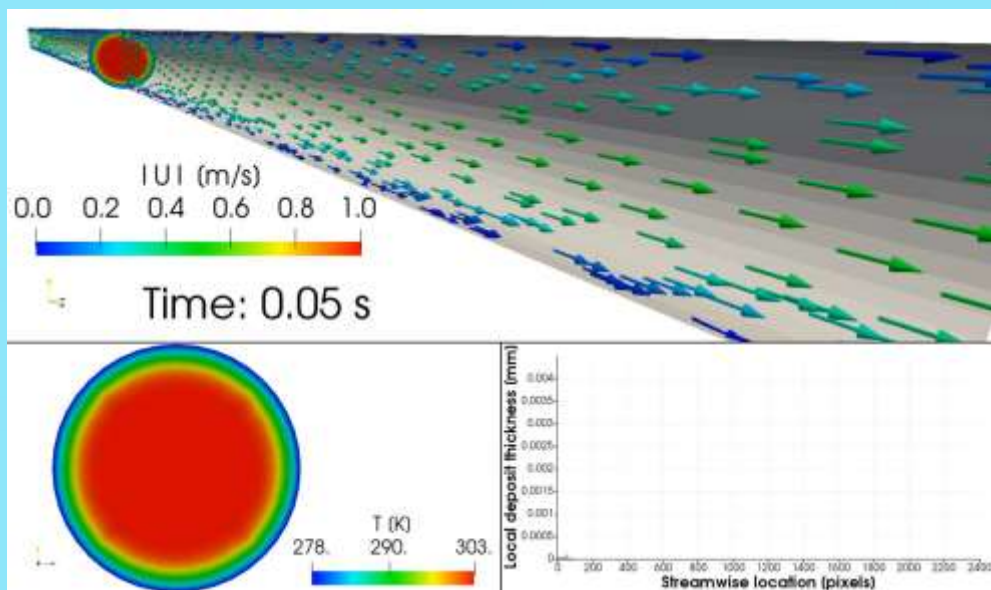
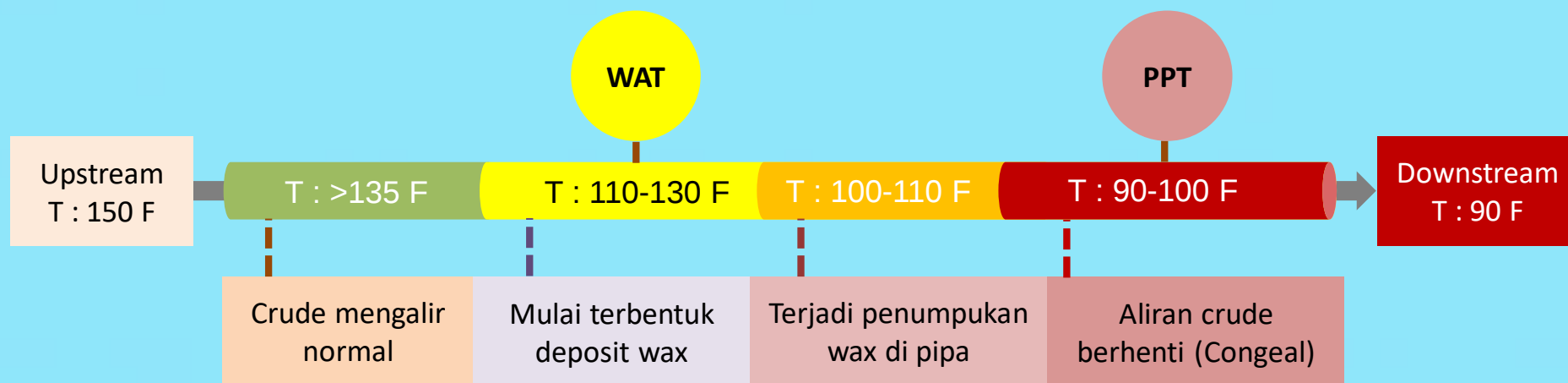
Limited Access
on shipping operation

Many Asset
to maintain

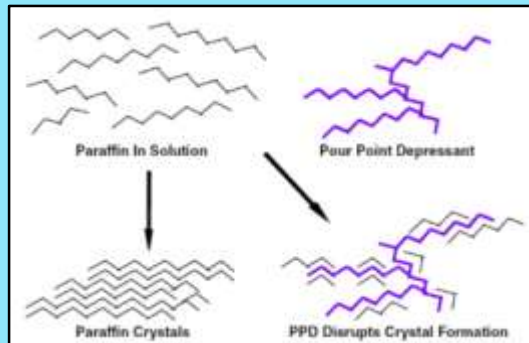


WHY HIGH RISK

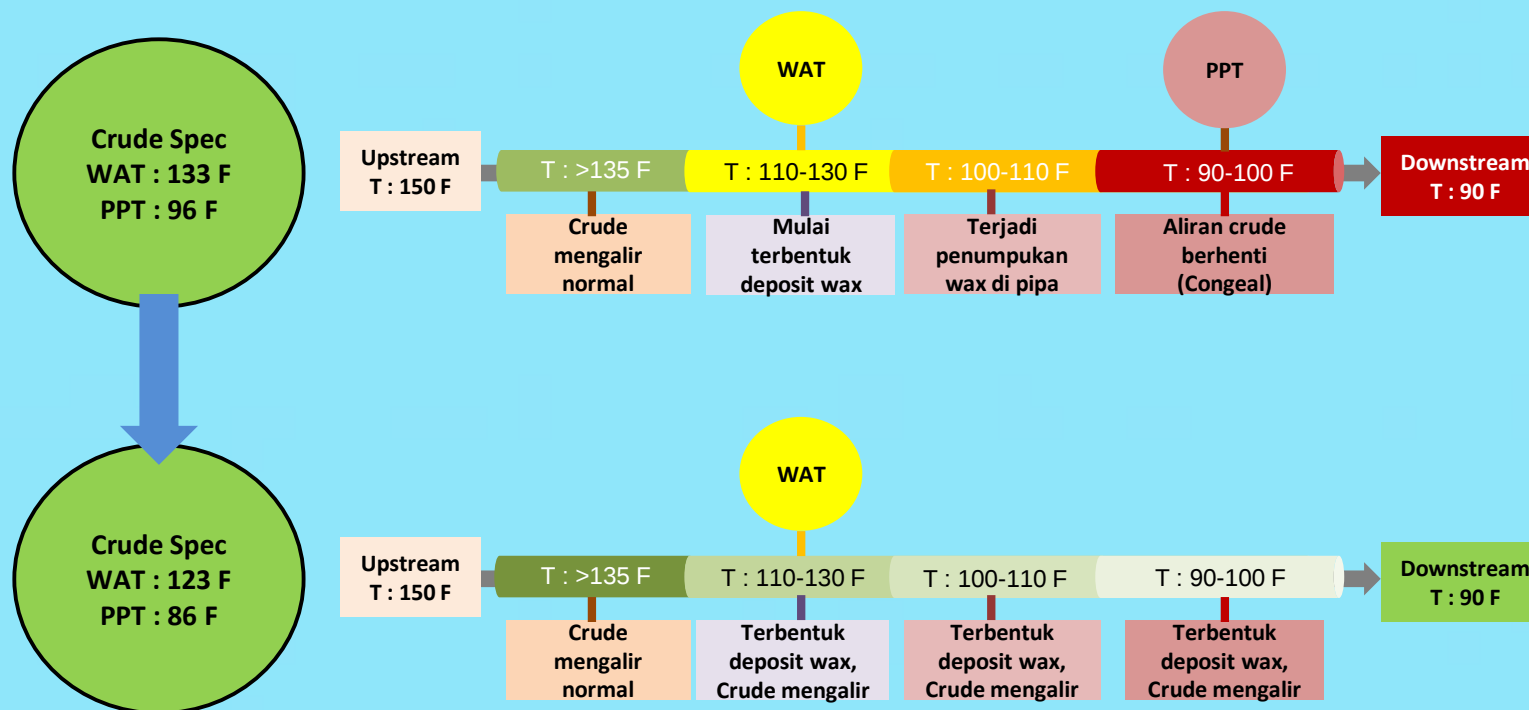
Crude Spec
WAT : 133 F
PPT : 96 F



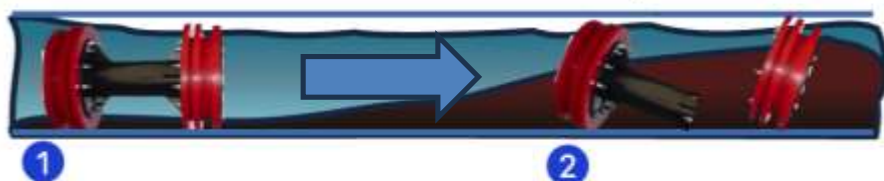
CONGEAL MITIGATION



- PPD merupakan suatu **bahan aditif** berbentuk wax berbasis polimer dengan rantai hidrokarbon cincin yang dapat mempengaruhi pembentukan zat lilin/wax.
- PPD yang diinjeksikan akan berinteraksi/bereaksi yang **menghambat pembentukan** dan pertumbuhan **kristal wax**.
- Penghambatan yang terjadi ini akan berdampak pada **menurunnya nilai PPT**



IMPORTANCE OF PPD PERFORMANCE



- 1 pig berjalan normal
- 2 pig terdisintegrasi karena menabrak hard wax, aliran crude ter-bypass

Root cause : Hard Wax due to PPD not performed well

- Investigation report 2024-



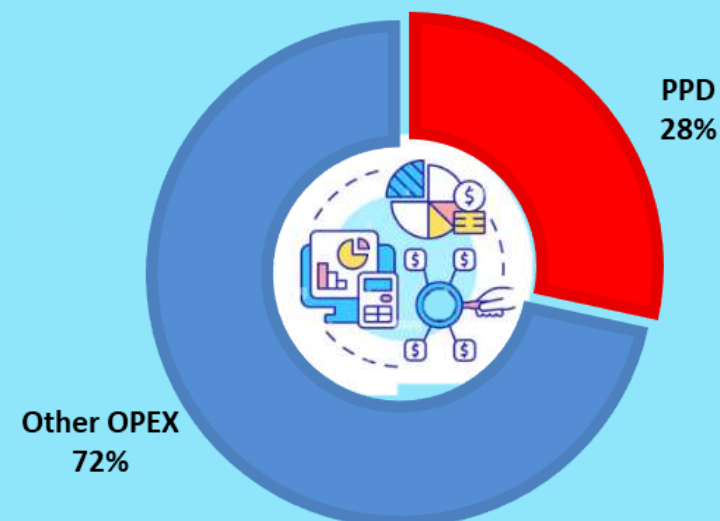
DAMAGE COST (IDR)

Pig Stall Segment 9
(6 days combat)

3.000.000.000

Pig Stall Segment 7
(7 days combat)

5.000.000.000



S.T.A.R IDENTIFICATION

SITUATION

OPERATION CHALLENGE

TASK

- ENSURE PERFORMANCE
- IMPROVE PROCEDURE

ACTION

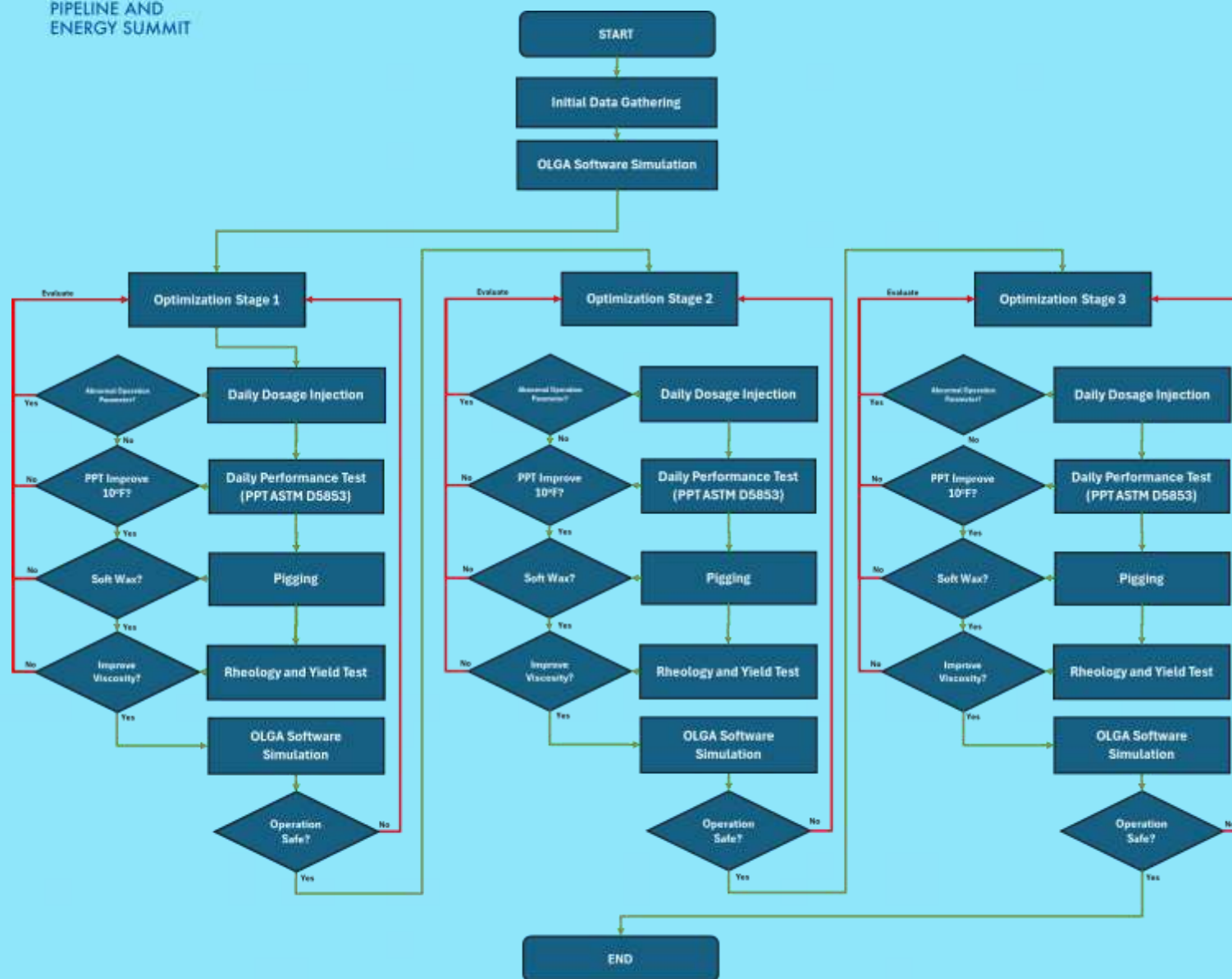
HOLLISTIC WAX MANAGEMENT

RESULT



NO INCIDENT & SAFE
OPERATION

HOLISTIC WAX MANAGEMENT



NORTH

500 PPM

450 PPM

400 PPM

SOUTH

1500 PPM

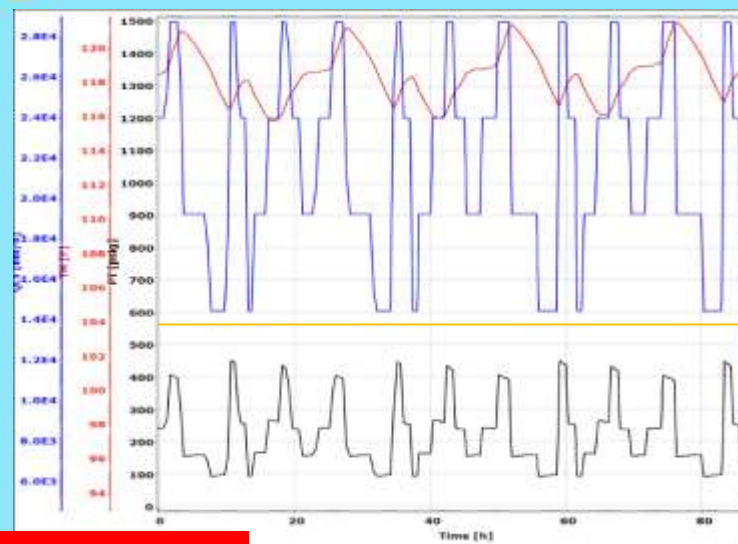
1100 PPM

850 PPM

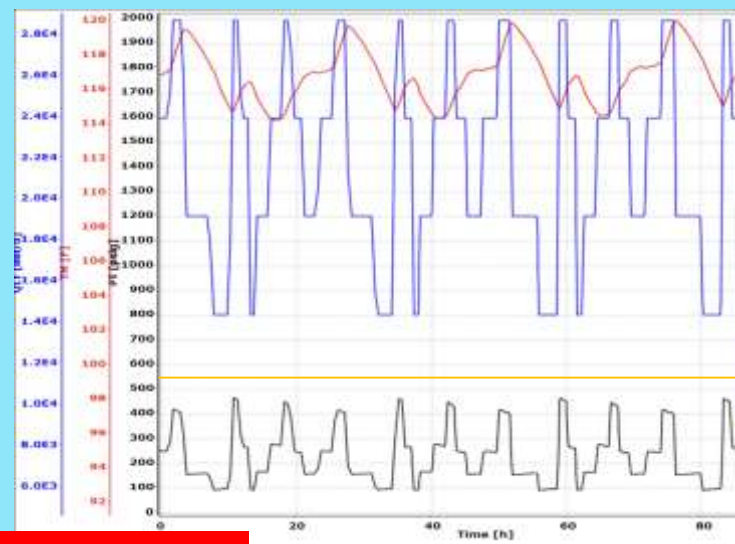
BACK PRESSURE SIMMULATION

PSHH pompa hulu : 580

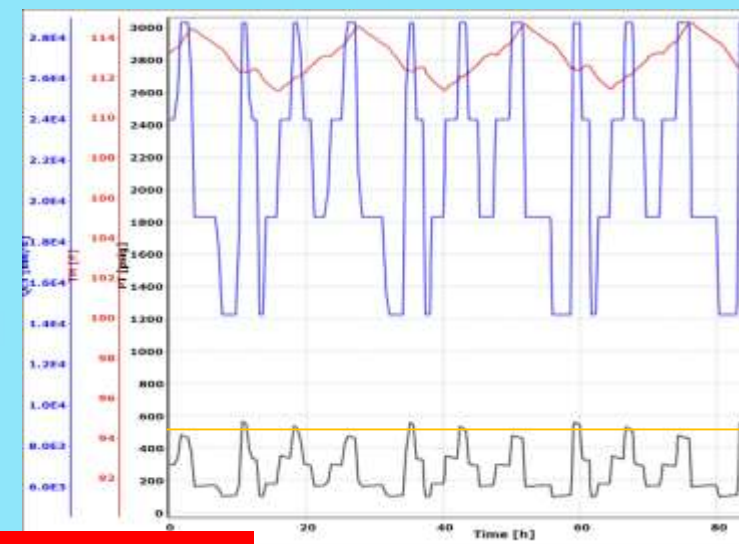
Psi



1500 PPM



1100 PPM



850 PPM

Keypoint:

1. Pressure tidak mencapai batas PSHH (**orange line**)
2. Flow yang mengalir masih tetap berada di angka 29000 BOPD karena limitasi size pipa

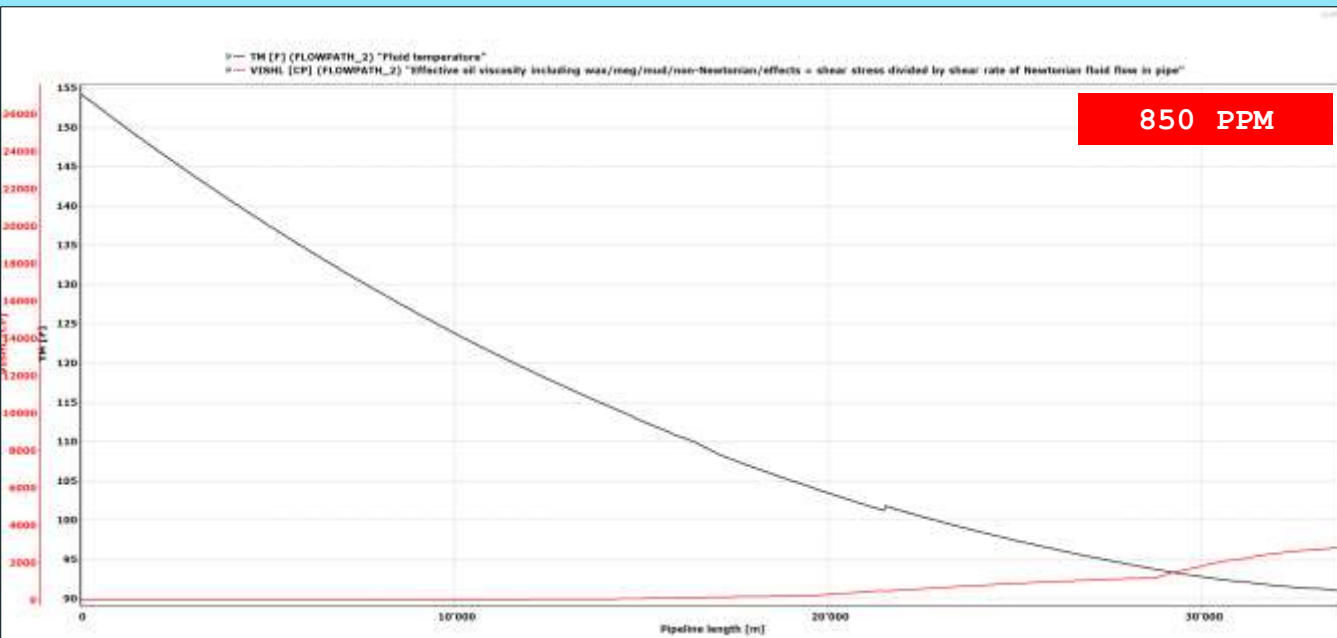
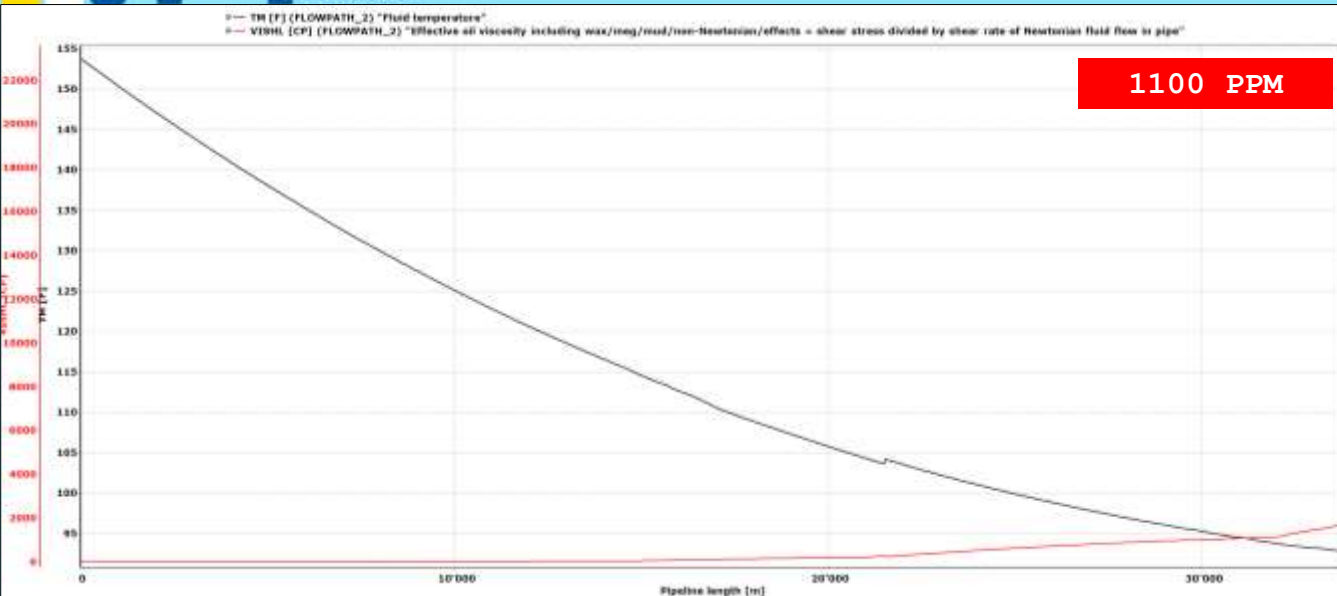
Keypoint:

1. Pressure tidak mencapai batas PSHH (**orange line**)
2. Flow yang mengalir masih tetap berada di angka 29000 BOPD karena limitasi size pipa

Keypoint:

1. Pressure sudah mencapai batas PSHH (**orange line**) yaitu 590 Psi sehingga aplikasi PPM 850 **tidak disarankan**
2. Flow yang mengalir masih tetap berada di angka 29000 BOPD karena limitasi size pipa

TEMP REDUCTION SIMMULATION



PPT crude segment 4 treated :

91 F

Keypoint:

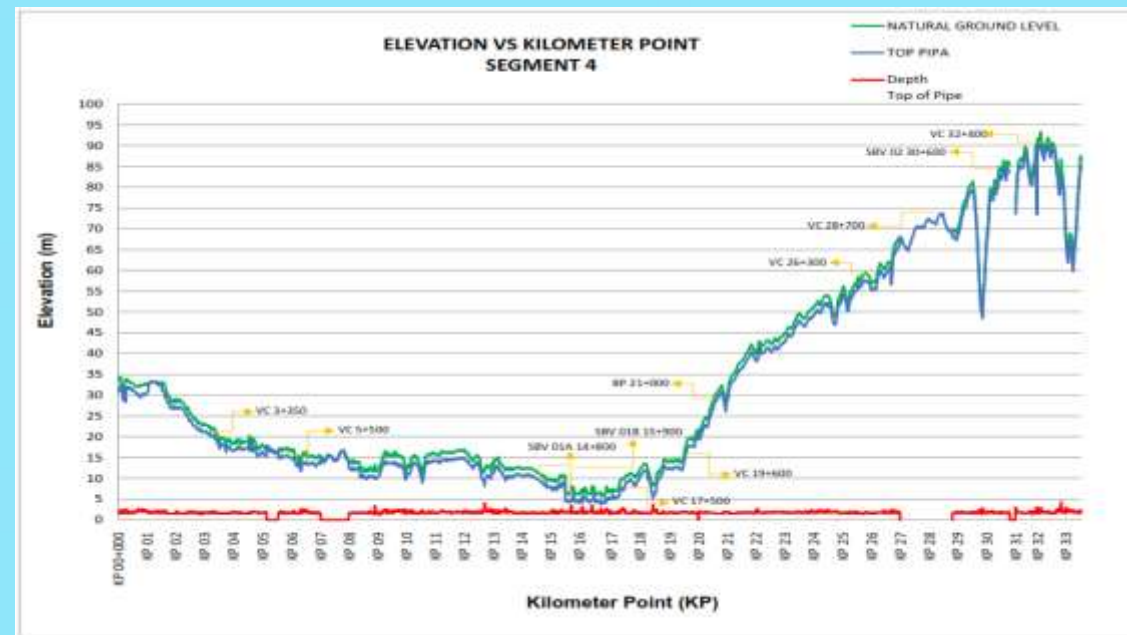
1. Kenaikan viskositas (**red line**) terjadi secara signifikan ketika dosis 850 PPM diinjeksikan yaitu 2600 cP vs 1800 cP (dosis 1100 PPM) dimulai pada KP 20.
2. Temperatur hilir Dosis 1100 PPM = 93 F
3. Temperatur hilir Dosis 850 PPM = 91 F

Viscosity

Speed

Laminar

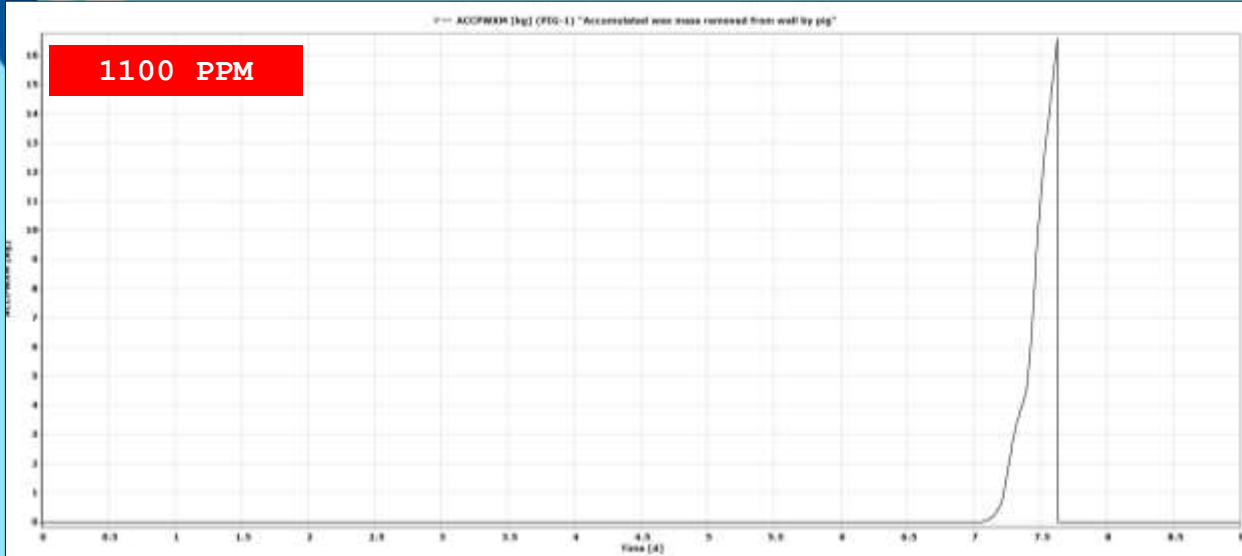
Temp



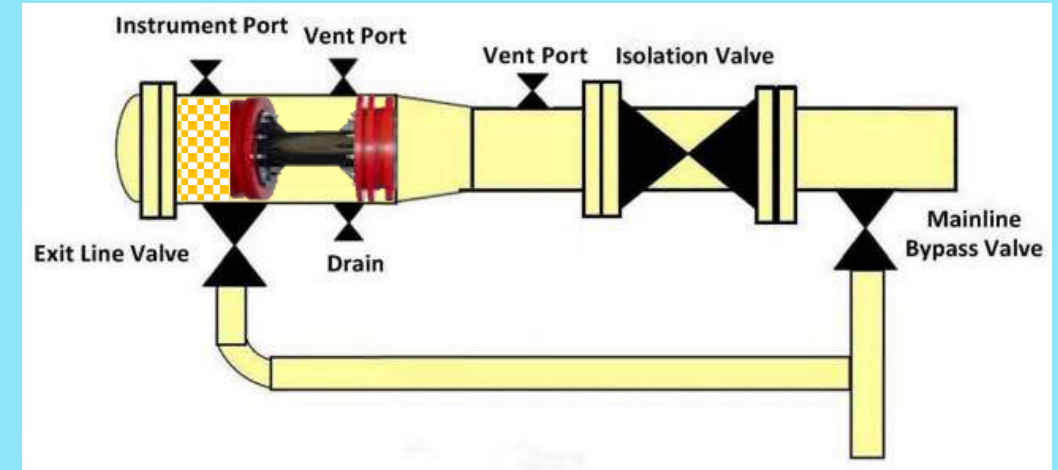
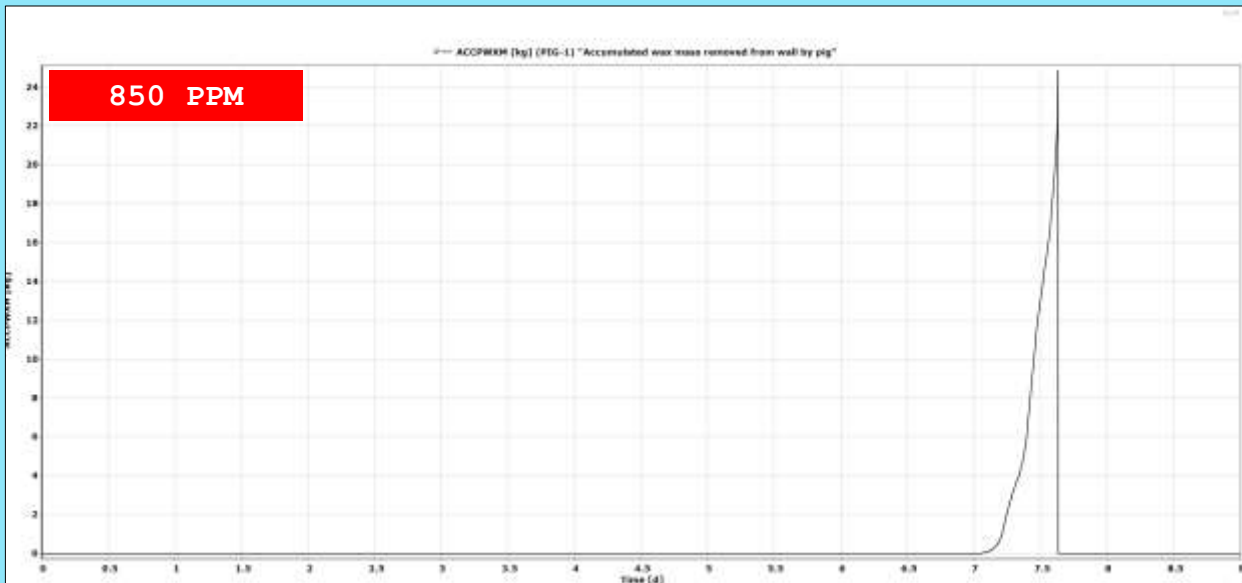
WAX ACCUMULATED SIMULATION

30% barrel receiver capacity =
90 Kg

1100 PPM



850 PPM



Sumber: <https://www.pipetechcorp.com/resource/pig-launching-receiving-best-practice-using-common-barrels/>

Keypoint:

1. Total wax terkumpul dalam 7 hari penyaluran:
 - 1100 PPM : 18 Kg
 - 850 PPM : 25 Kg
2. Wax terkumpul untuk 850 PPM masih di bawah dari batas aman untuk pipa 8" = 90 kg

SIMMULATION RESULT

Area	Dosage	Pressure	Flow	Temperature	Wax
NORTH	500	PASS	PASS	PASS	PASS
	450	PASS	PASS	PASS	PASS
	400	PASS	PASS	PASS	PASS
SOUTH	1500	PASS	PASS	PASS	PASS
	1100	PASS	PASS	PASS	PASS
	850	FAIL	PASS	FAIL	PASS

Keypoint:

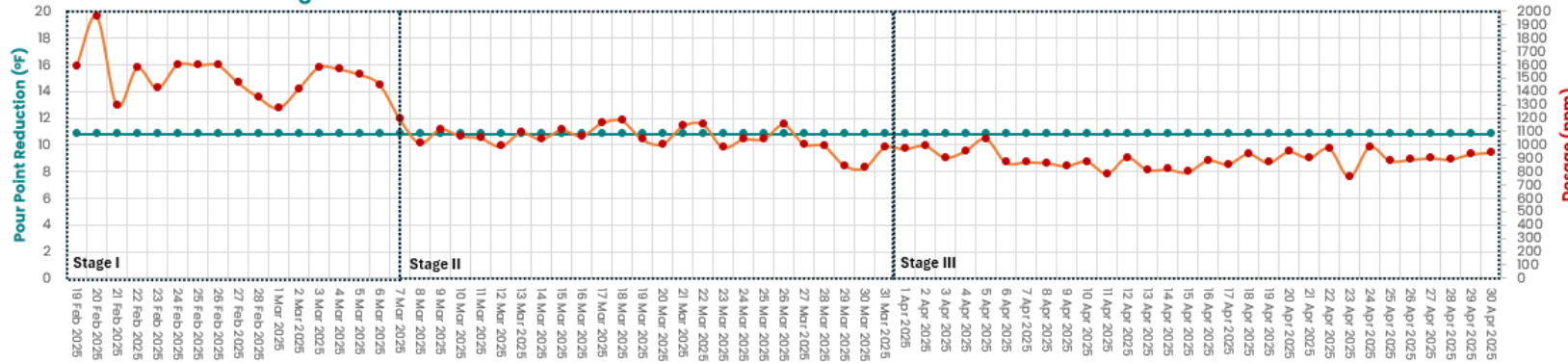
1. Seluruh Skenario penurunan dosis dapat dijalankan untuk area North
2. Untuk area South 850 PPM tidak direkomendasikan untuk dijalankan, dan disarankan untuk menggunakan dosis yang lebih tinggi



Field Application

PERFORMANCE RESULT - SOUTH

Performance VS Dosage for South Area



Wax Appearance Analysis from Pigging South

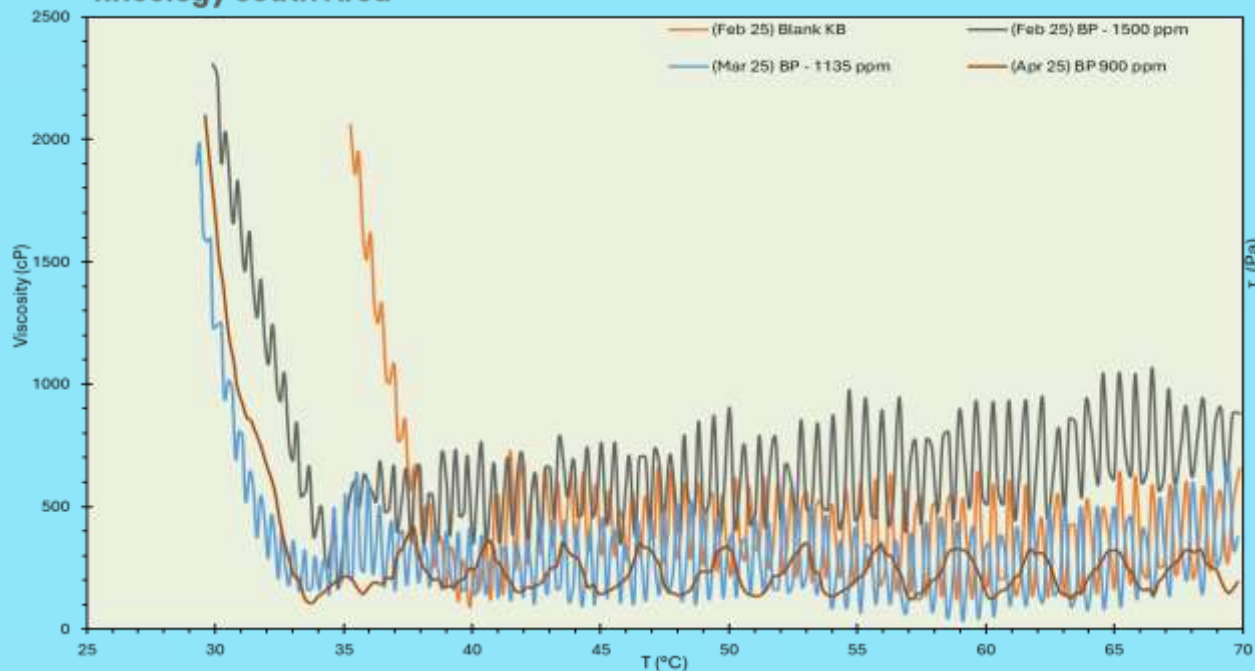


Keypoint:

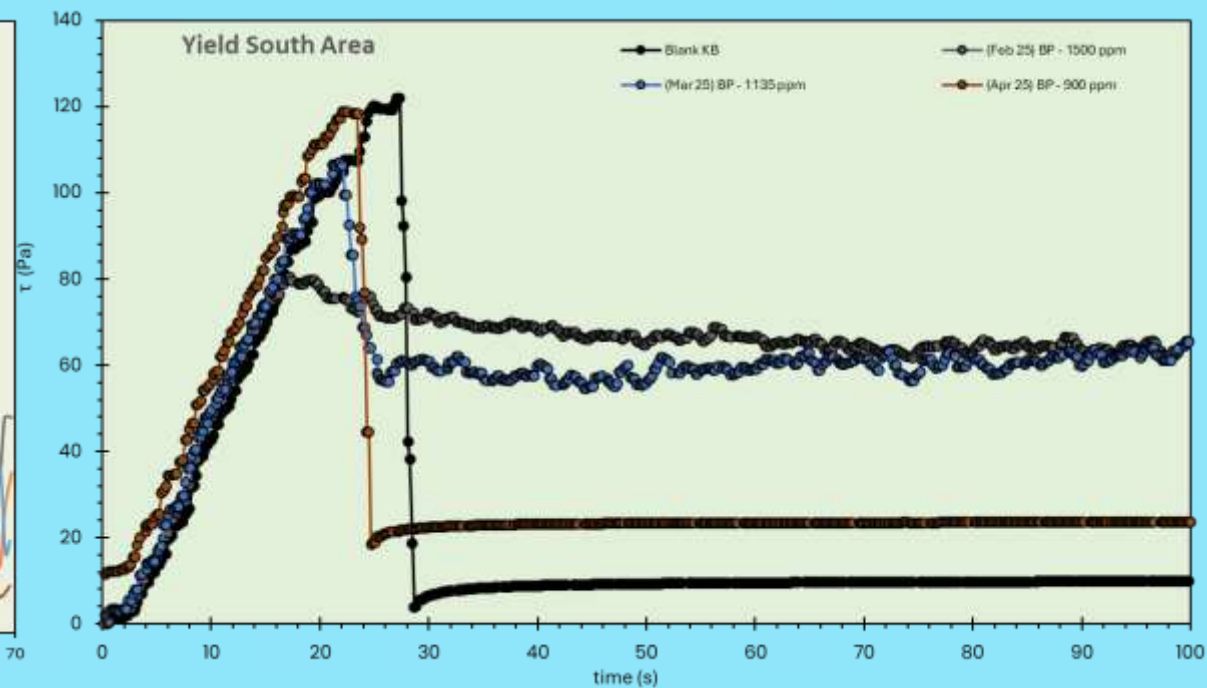
1. Performa **penurunan PPT** masih **terjaga 10°F** dengan adanya penurunan dosis
2. Dosis akhir yang digunakan adalah di rata-rata **900 PPM**
3. **Wax** masih **dalam batas aman** dari yaitu **<30%** kapasitas barrel receiver pig
4. Terdapat temuan **hardwax** di akhir bulan April = **patut diwaspadai**
5. **Tidak ada insiden** terjadi selama periode optimalisasi

PERFORMANCE RESULT – SOUTH

Rheology South Area



Yield South Area



Keypoint:

1. Masih terdapat pergeseran kurva viskositas untuk area north dan south yang menandakan bahwa adanya PPD masih berperan untuk memperbaiki viskositas
2. Kurva Yield memberikan hasil bahwa dengan PPM 850 - 900, nilai yield treated mendekati nilai yield blank

OVERALL FIELD RESULT

Area	Dosage (PPM)	PPT Perform	Pigging	Wax	Rheology (Viscosity)	Yield	Safe Operation
NORTH	500	PASS	PASS with note!	PASS	PASS	PASS	PASS
	450	PASS	PASS with note!	PASS	PASS	PASS	PASS
	400	PASS	PASS with note!	PASS	PASS	FAIL Proceed with note!	PASS
SOUTH	1500	PASS	PASS	PASS	PASS	PASS	PASS
	1100	PASS	PASS	PASS	PASS	PASS	PASS
	900	PASS	PASS with note!	PASS	PASS	PASS	PASS

Daily Dosage Injection

Daily Performance Test (PPT ASTM D5853)

Pigging

Rheology and Yield Test

OLGA Software Simulation

Operation Safe?



Enough?

WAX APPEARANCE DATA



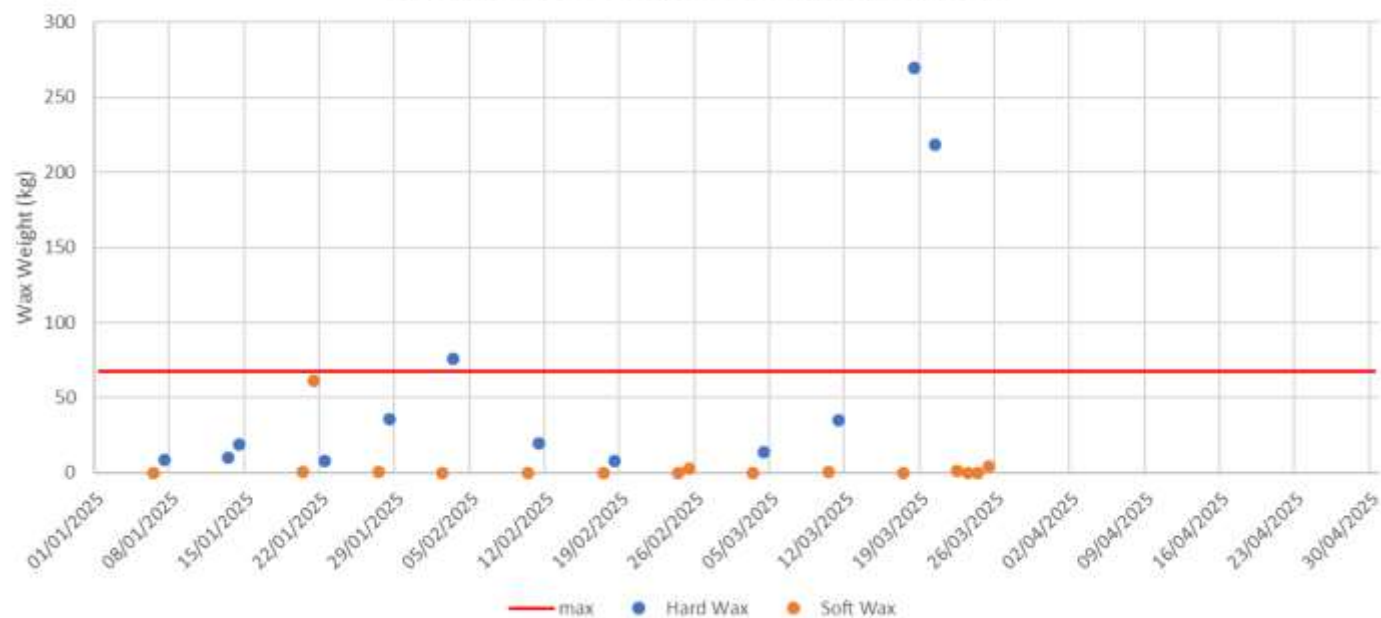
HARD WAX:

- Padat dan keras
- Butuh alat untuk mencacah

SOFT WAX:

- Licin
- Mengkilat
- Hancur dalam remasan tangan

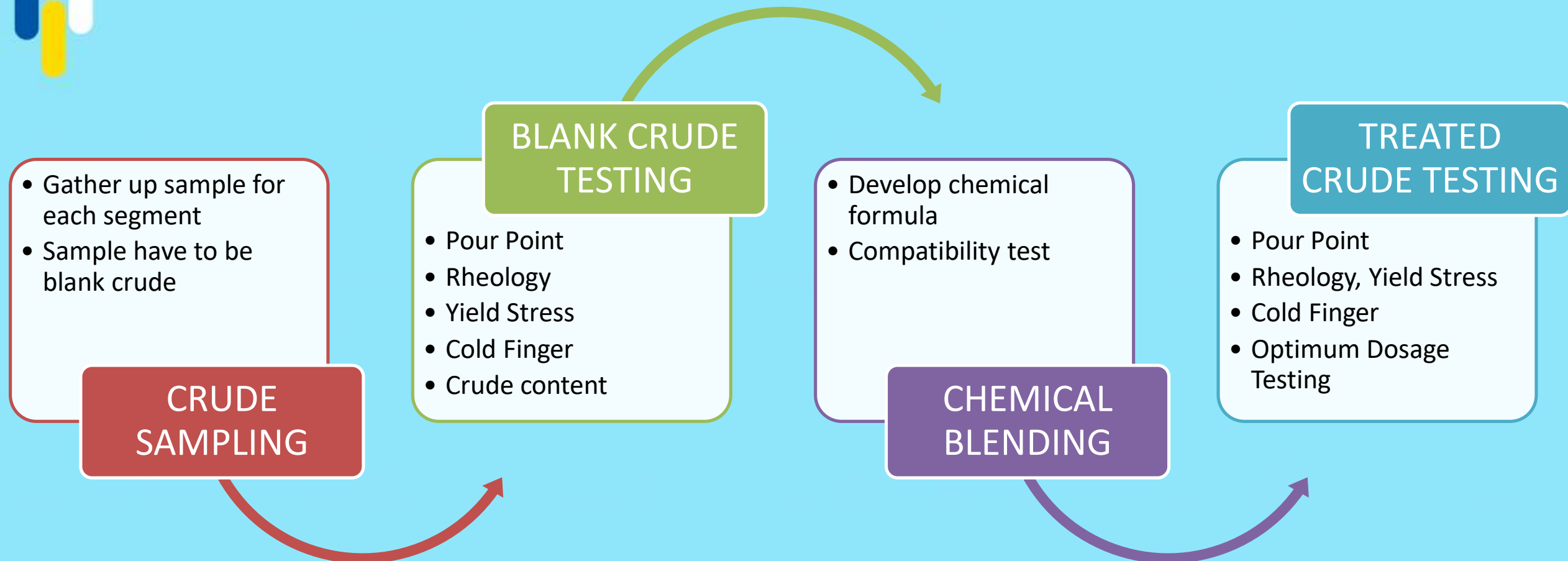
Wax Appearance Analysis from Pigging Segment 9



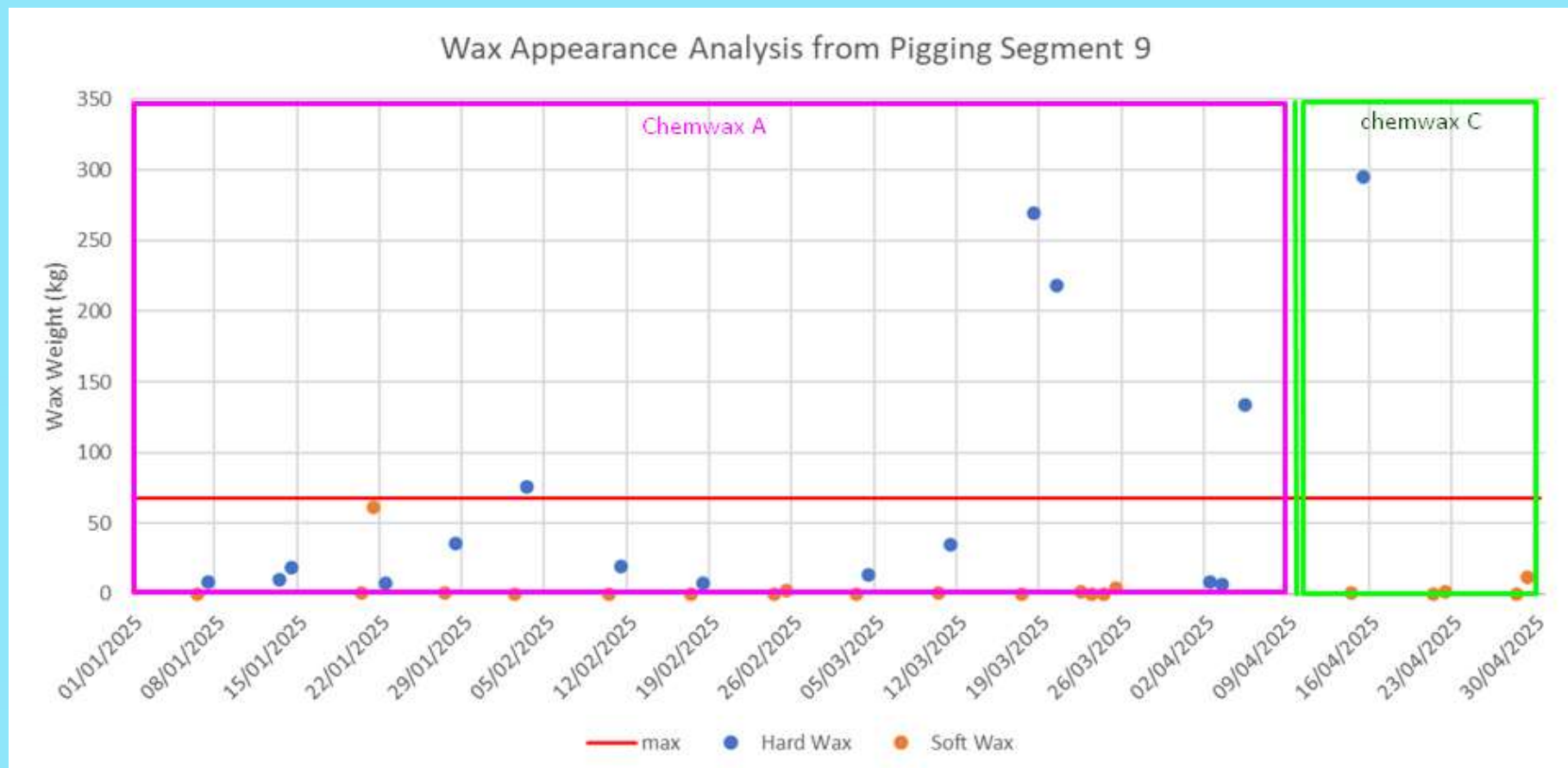
TARGET FOR NEW FORMULA:

1. Performa PPT tetap tercapai
2. Kompatibel dengan crude dan PPD existing
3. Menghasilkan wax yang lebih lembut

FINDING NEW FORMULA



NEW FORMULA RESULT



Result:

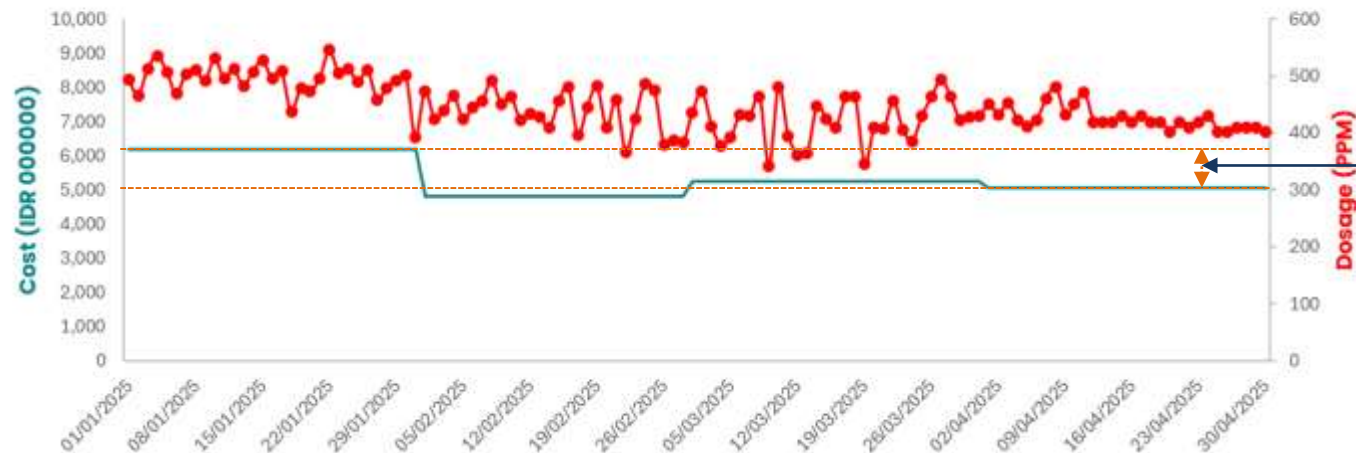
1. Hasil evaluasi pigging dengan chemical baru **berhasil** membuat wax menjadi lebih lembut dan jumlah yang sedikit
2. Adanya hard wax dengan nilai yang tinggi pada 15 April 2025, lebih disebabkan oleh matinya pompa injeksi PPD



**Wait for
More....**

OPEX

Dosage Consumption VS Cost for North Area



- 18% cost reduction

25% / year

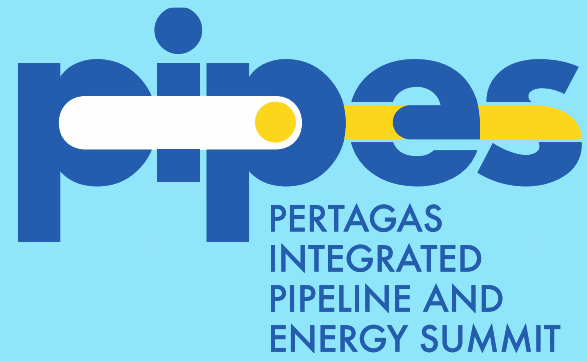
Dosage Consumption VS Cost for South Area



- 30% cost reduction

WRAP UP

1. **Hollistic Wax Management** entails a sequence of actions to validate the choice of a secure dosage for ongoing operations.
2. **Holistic Wax Management** implemented in Rokan Field has demonstrated **its effectiveness in ensuring flow assurance** during crude oil transportation **while upholding safe operations**.
3. **Crude assay** shall be conducted annually to review any changes of crude characteristics and review PPD Formula
4. **Automation Injection System** can be applied for further optimization process



TERIMA KASIH

let's connect!

