

High Paraffin Content and Long Distance – A Particular Challenge for Cleaning and Inspection of a Crude Oil Pipeline



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Intention

- High paraffin contents represent a significant challenge when it comes to In-Line Inspection, especially in long distance pipelines.
- This case study demonstrates how this can be dealt with to receive quality inspection results.

Project Introduction

- Pipeline details:
 - onshore crude oil transport pipeline
 - 18"/232km long, built in 1988
 - located in Gabon, Central Africa
 - starts at Rabi oil field (Shell)
 - tie-ins from Coucal (Total) and Marathon's offshore production
 - ends at Cap Lopez Tanker Terminal

What is different in this line?

- long distance
- low flow as production has decreased significantly
 - → 0.2m/s / 0.43m/s / 0.66m/s
 - → approx. 5 to 6 days run time
- high paraffin content in crudes' composition

Pigging background

- frequent bidi cleaning pig runs
- successful MFL inspection in 2003
- non-successful MFL inspection in 2008
 - → inspection tool plugged with paraffin and inoperative after approx. 13km

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Steps of the Project Engineering:

- review all information about previous cleaning
- consider options for markering
- establish cleaning and inspection program
- design cleaning tools
- design inspection tools

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- Pipeline Cleanliness:
 - Experience from last inspection
 - small volume of soft paraffin during cleaning
 - large volume of hard paraffin plugged the inspection tool



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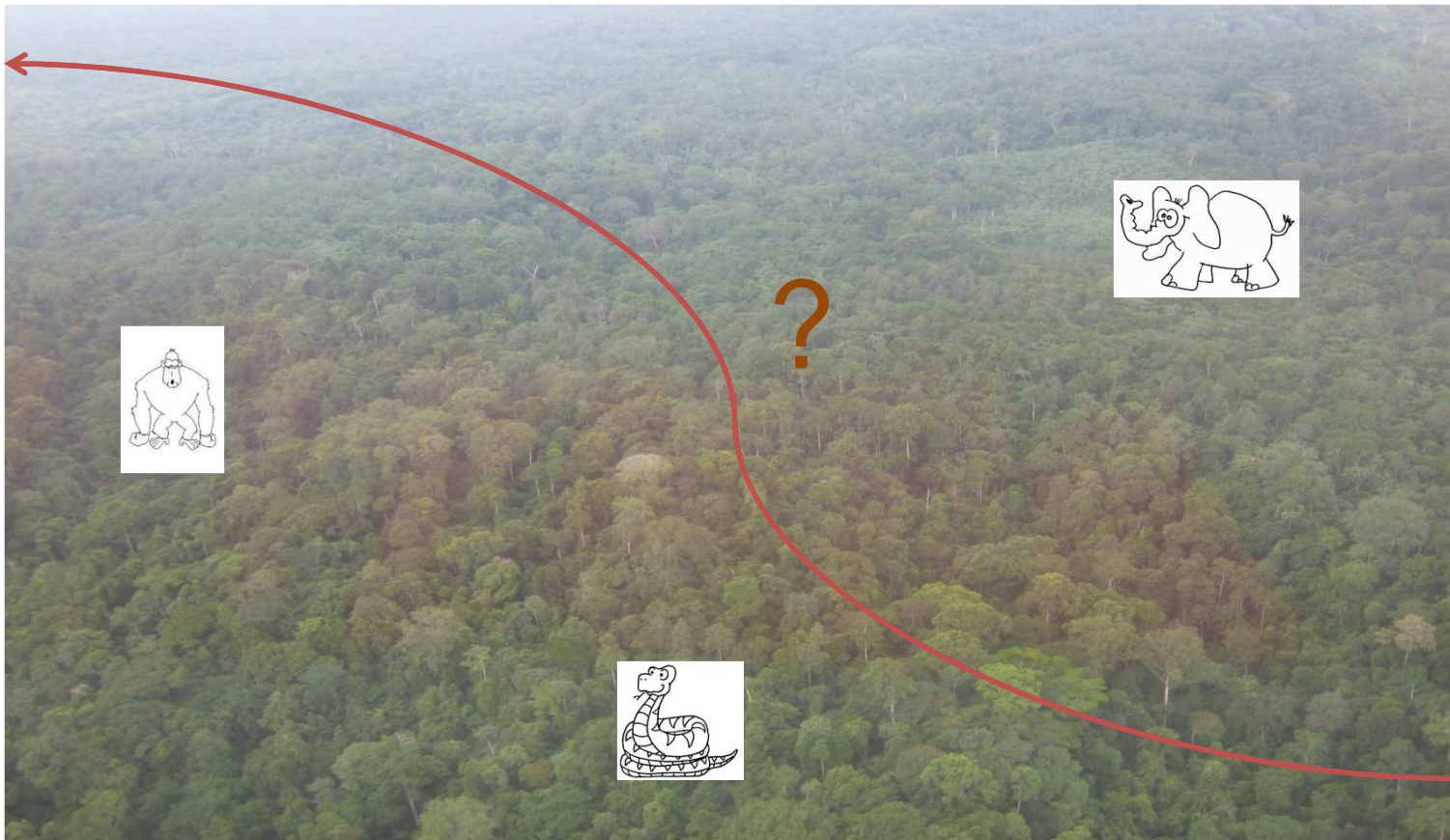
- Pipeline Cleanliness:
 - Experience from bidi cleaners
 - sometimes 20-50kg, sometimes hundreds of kg
 - consistency varies from soft to hard paraffin



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- Markering
 - approx. 150 marker locations required
 - right of way
 - entire project of its own to be synchronised with inspection pigging operations
- Solution:
 - from the 2003 inspection, a pipe tally and very well documented marker locations did still exist
 - 3P could align its data to the old pipe tally

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Picture: Right of way covered by jungle

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- Cleaning and inspection program:
 - 3P to build suitable cleaning tools and transfer to Gabon
 - TEPG to do a first cleaning with these tools
 - 3P to check whether the cleaning was successful and the actual cleanliness of the line
 - further cleaning operations if required
 - MFL inspection

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- Cleaning tools to be applied:



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- Inspection tools to be applied:
- GEO+:
 - combination of GEO and DMR sensors
 - measures internal diameter
 - distinguishes between paraffin and metal
- → provides high value information on cleanliness of the line

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Picture: GEO+ tool applied

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- Inspection tools to be applied:
- MFL:
 - high resolution MFL tool
 - very long battery life time (>6 days)
 - high „paraffin resistance“ package



Phase I – Pre-Cleaning

- TEPG ran cleaning pigs (one at the time)
- 3P reviewed results from Germany
- decreasing volumes of paraffin
 - 800kg per pig → <20kg per pig
- → mobilised GEO+

Phase II – 3P gauging and cleaning

- after months of TEPG cleaning, 3P mobilised engineers, profile pig and GEO+
- profile pig run received with 100kg paraffin



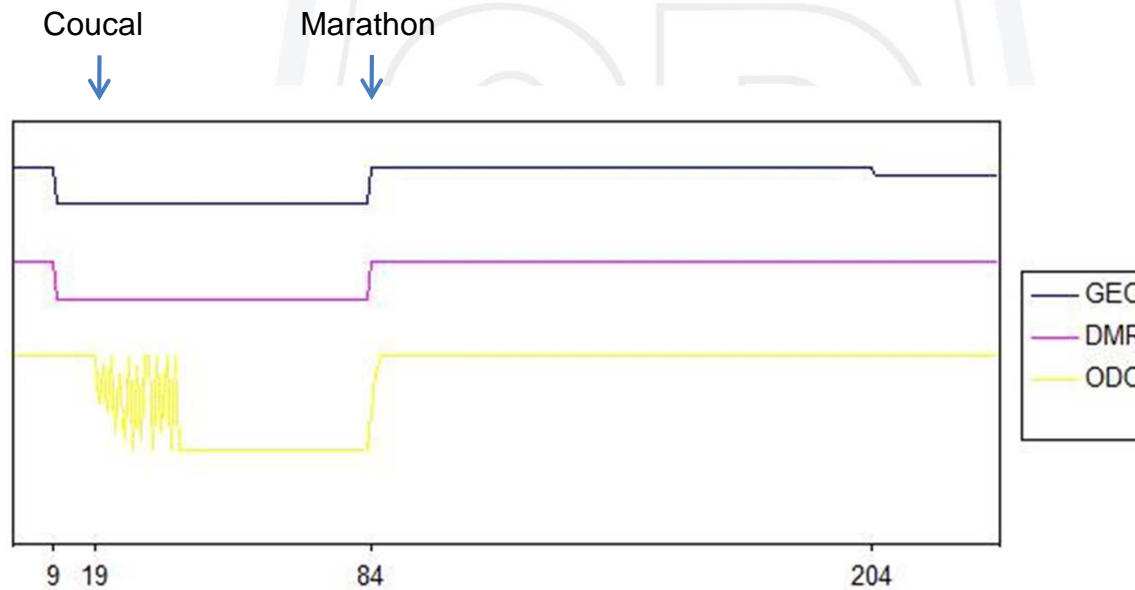
Phase II – 3P gauging and cleaning

- further cleaning pig runs with multiple pigs in the line
- → approx. 500kg of paraffin has still been removed



Phase III – GEO+ Inspection

- Results of GEO+ inspection:

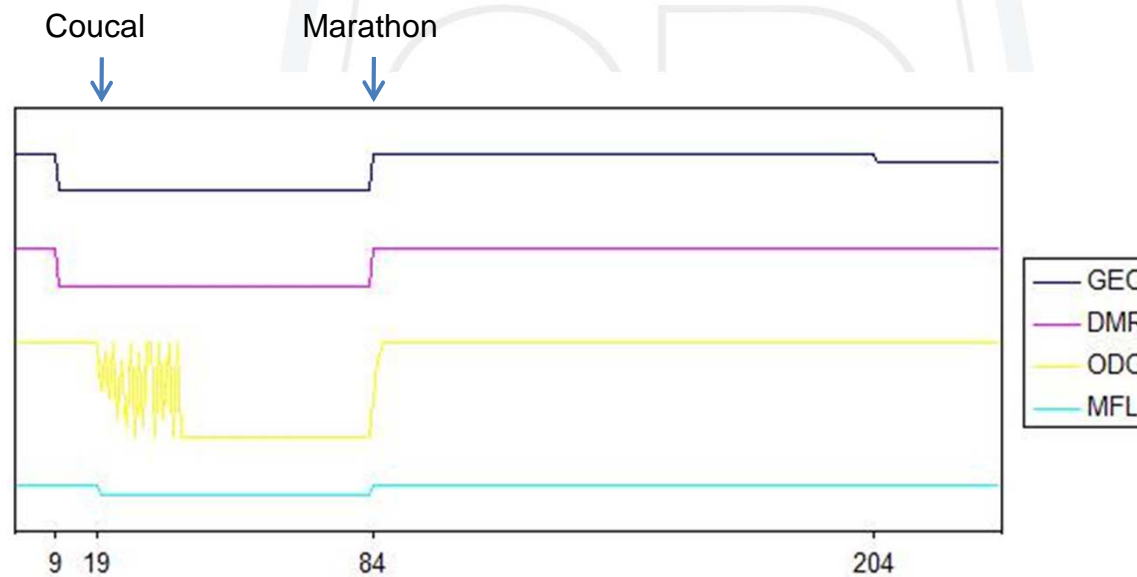


Phase III – GEO+ Inspection

- Results of GEO+ inspection:
 - no critical restrictions, but data degradation likely
 - paraffin issues locally restricted
 - good chance that MFL tool will recover behind Marathon Tee
- → decision was taken to go for the MFL instead of doing further cleaning activities

Phase IV – MFL Inspection

- Results of MFL inspection:



Phase IV – MFL Inspection

- Results of MFL inspection:
 - odometer slippage between Coucal and Marathon
 - → was aligned to 2003 distance measurement
 - only minor data degradation between Coucal and Marathon
 - correction factor was calculated for paraffin influence
 - several defects could already be verified which confirmed the results of the inspection

3P Services says...

