Case Study:
Internal Corrosion in a Gas Pipeline

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Background

- ✓ Age of pipeline 3 years at the time of ILI
- ✓ Clean product, free of any corrosive constituents
- ✓ ILI conducted to collect base line data
- ✓ Total 8 runs of pigging
- ✓ More than 1500 kg of debris during ILI
- ✓ RCA conducted by pipeline operator

Detail of Pipeline

- ✓ Age of Pipeline:- Approx. 3 years at time of ILI
- ✓ Pipeline Product:- Dry Natural Gas
- ✓ Pipeline size- 8” Dia., 50 KM length
- ✓ Type of the Pipe used:- ERW, grade API 5L X60
- ✓ Internal coating- nil, External coating- 3PE
- ✓ Pipeline design pressure- 90 bar, MAOP 84 bar
- ✓ No corrosive constitutes in pipeline product
- ✓ ILI conducted with combination of MFL-A & MFL-C

Overview of Field Activities

- Salient Points of field activities-
  - ✓ 160 Kg quantity of debris in initial few cleaning runs
  - ✓ More than 450 Kg of debris along with EGP run
  - ✓ 300 kg more debris before next run (Cleaning)
  - ✓ With MFL tool & after that 600 kg more debris received
  - ✓ Till last run of the pigging, more than 1500 kg of debris had been received.

Overview of Field Activities

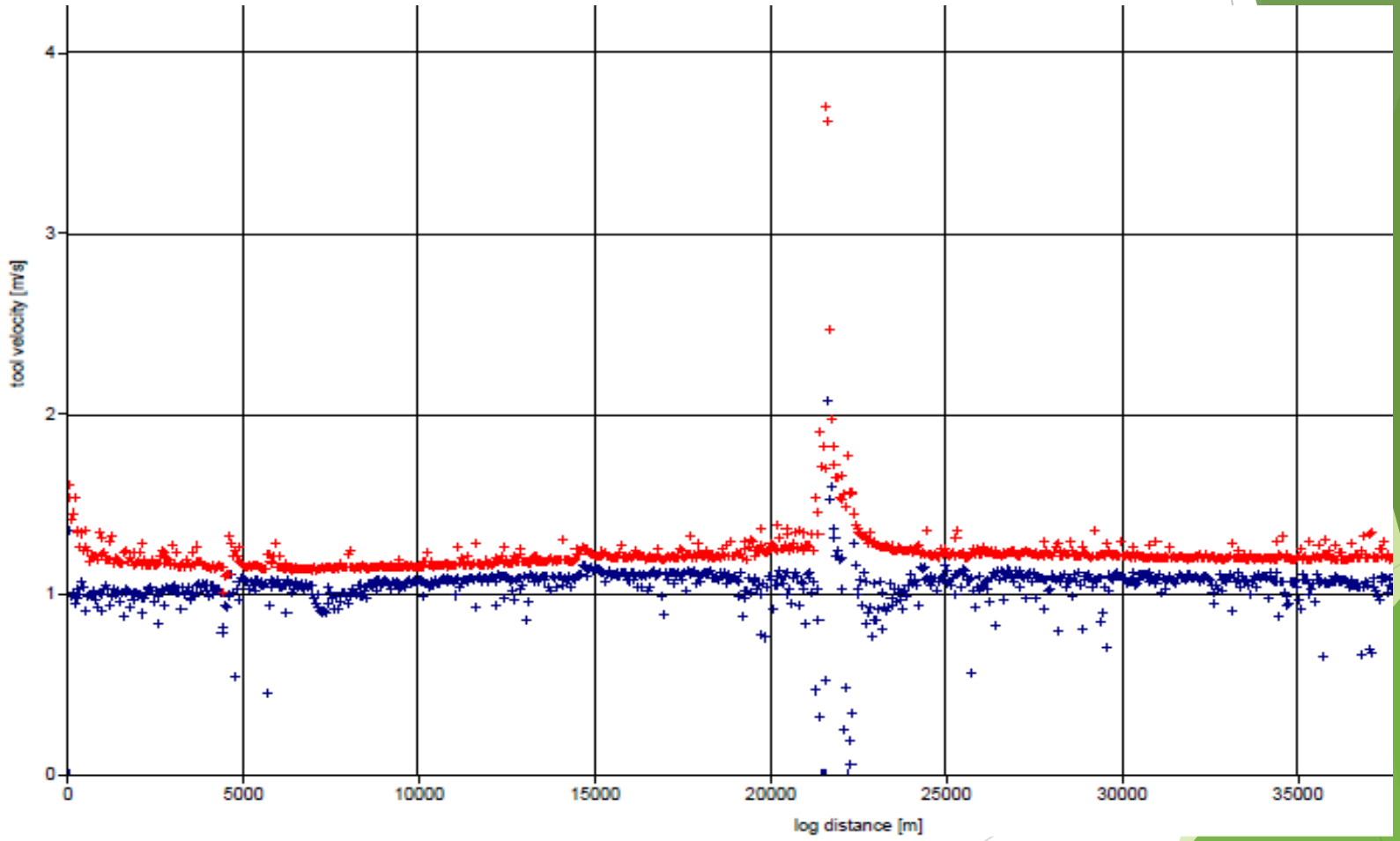
BMD Before Run

Overview of Field Activities

BMD After Run

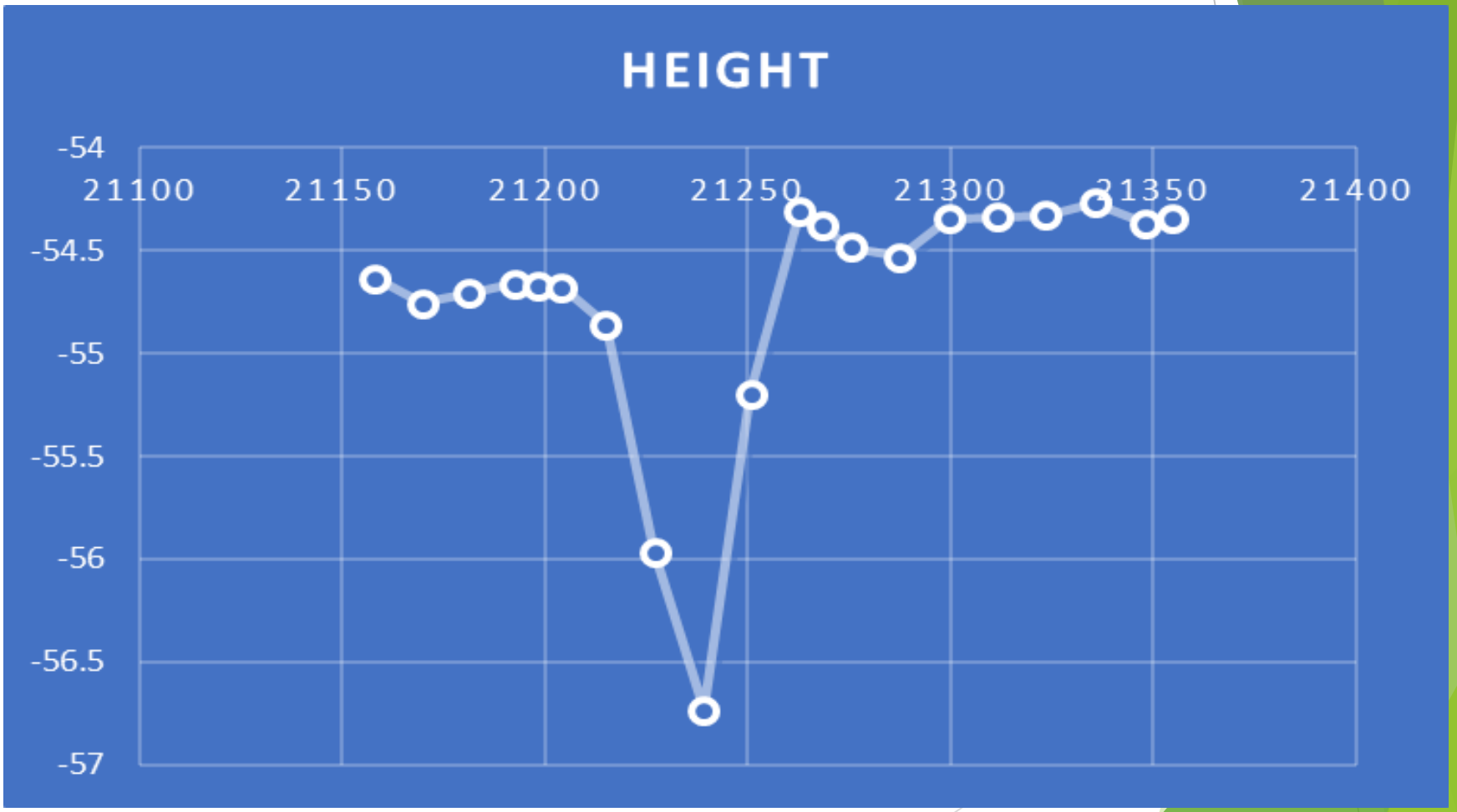
Overview of Field Activities

- **EGP run- tool speed V/s log distance**



Overview of Field Activities

Pipeline elevation profile at tool stuck location



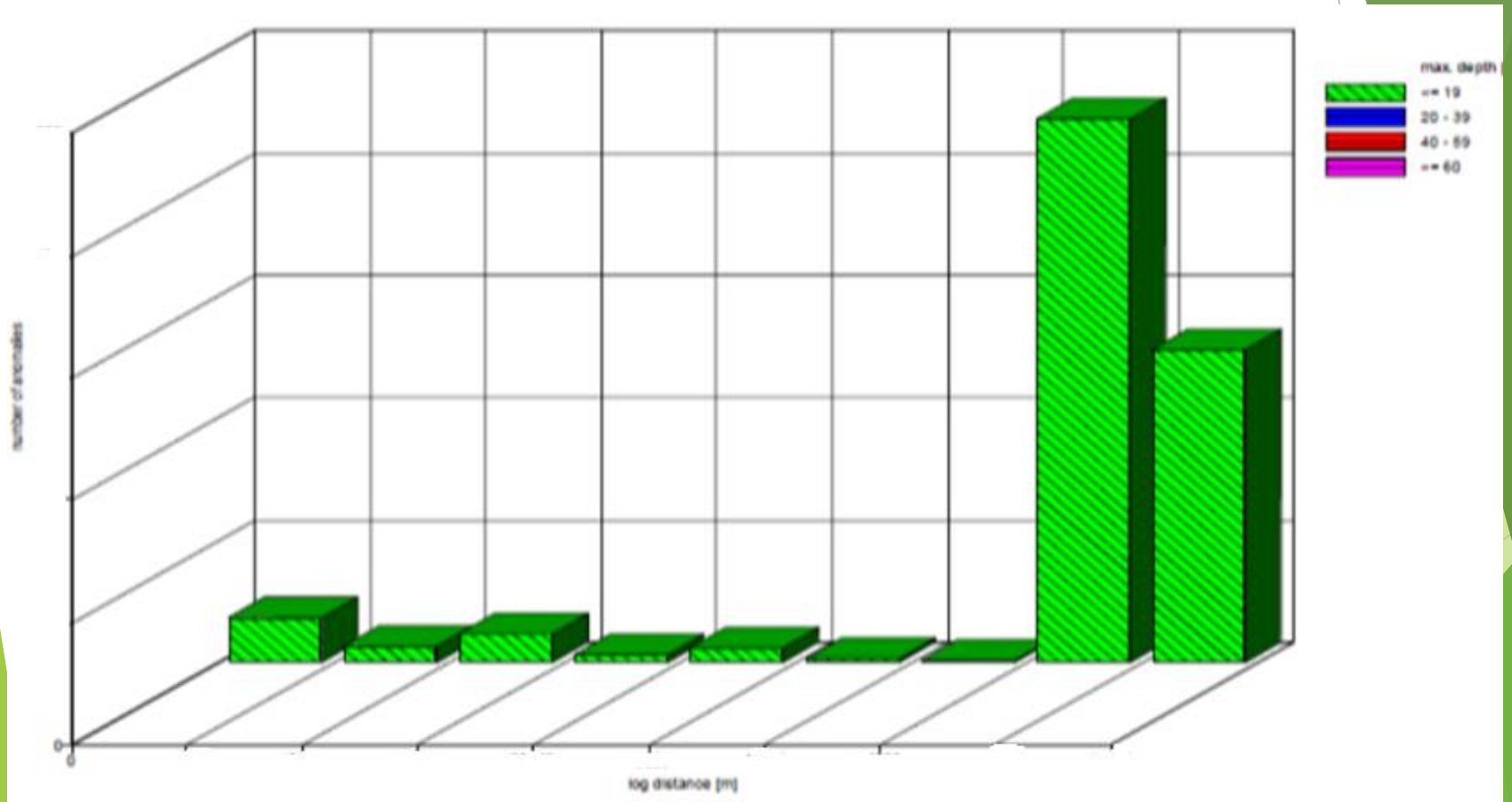
Study of ILI Report

Summary of ILI report

- ✓ **780 internal metal loss anomalies** with wall loss exceeding the reporting threshold (10%).
- ✓ All defects having wall loss less than 20%.
- ✓ Maximum ERF found to be 0.9
- ✓ 90% of these defects were concentrated in last 20% of the pipeline section.
- ✓ 1st 80% length of the pipeline have only 10% of the total no. of the defect.
- ✓ 16 no of pipe joints (in 3 sections) have 660 (>85%) of the defects

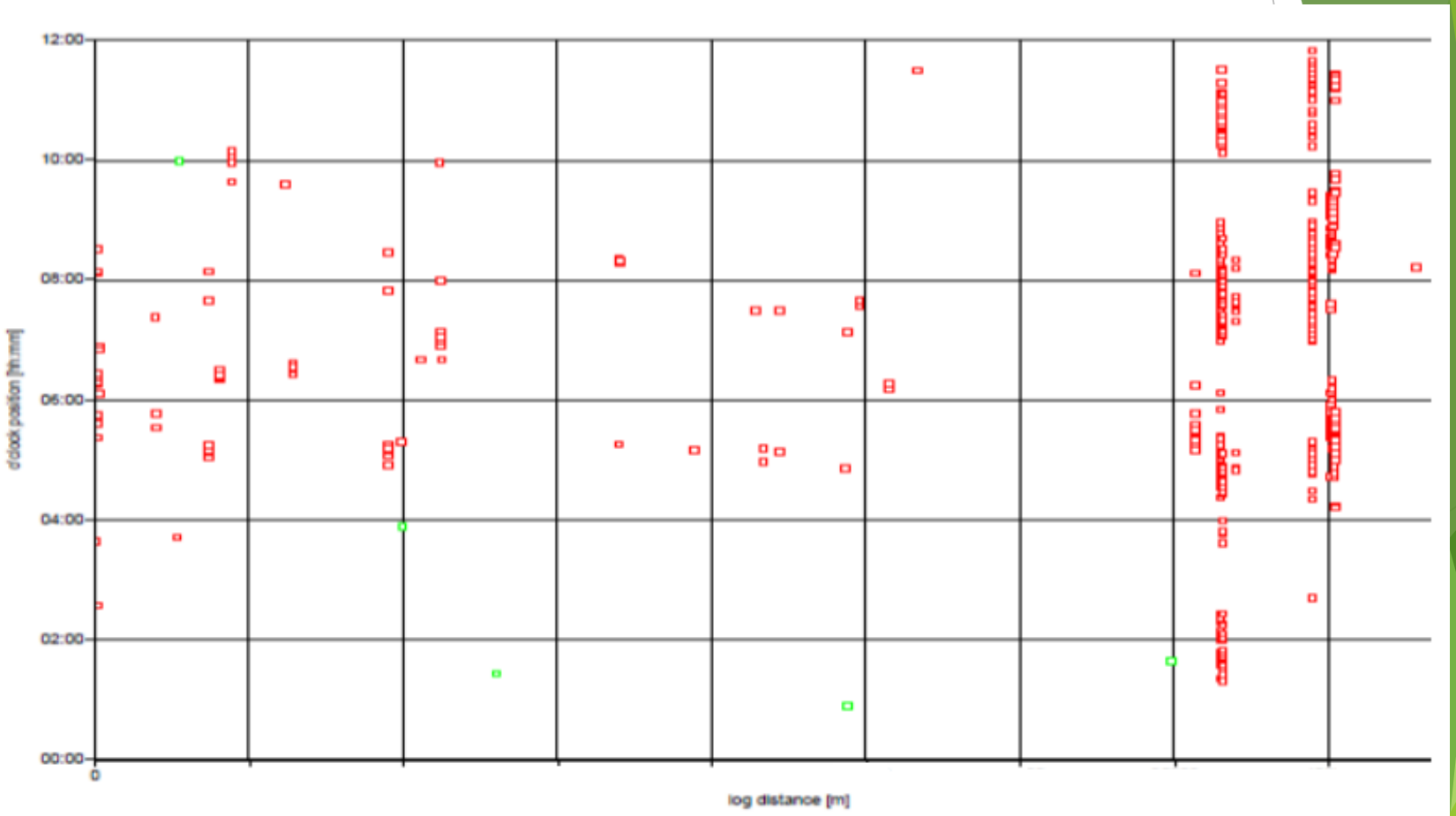
Study of ILI Report

Anomaly distribution along the length of the pipeline



Study of ILI Report

- **Defects were randomly oriented all along the circumference & not at specific orientation-**



❖ **Section 1**:

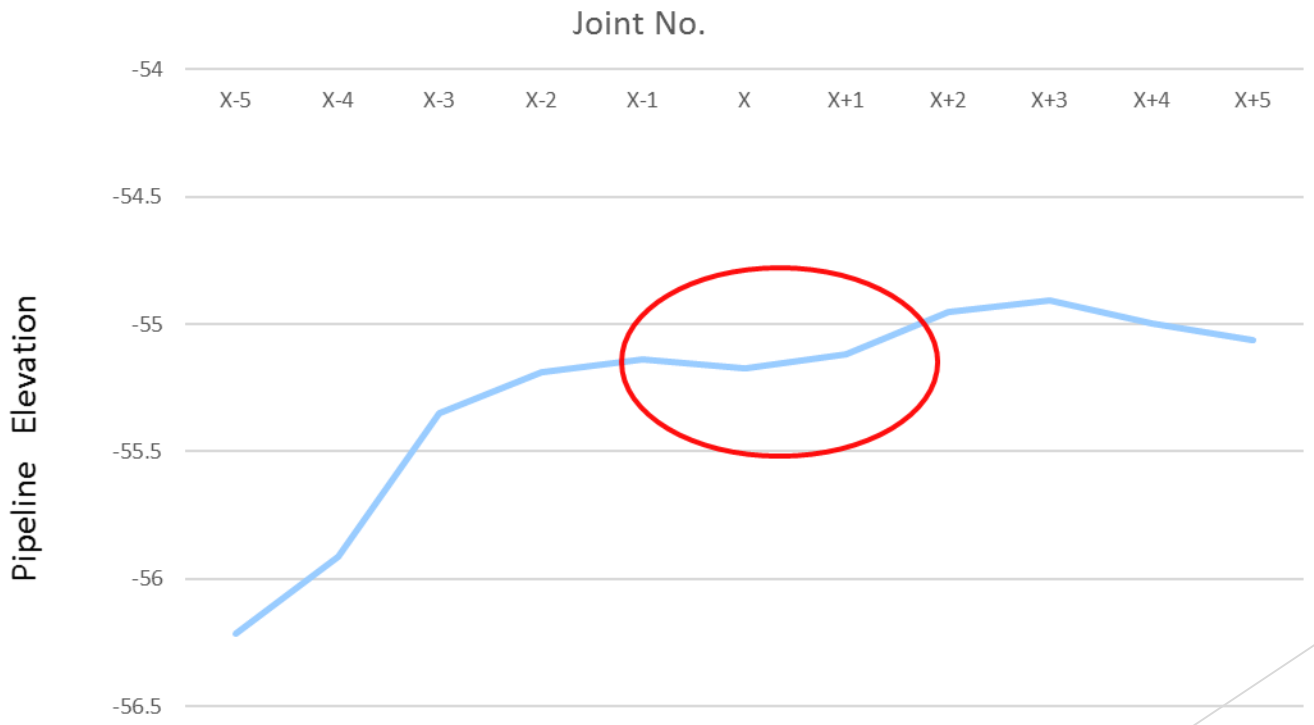
Construction of this entire section at same time. However, different orientation of the defects suggests the corrosion might have happened possibly at pipe mill or storage yard.

Joint No	Total no of defects	Orientation of >80% of defects	Stringing	welding	lowering	Hydrotest
31170	143	7 to 8:30	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17
31171	10	1:30 to 2:30	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17
31172	9	10:30 to 11:30	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17
31174	32	10:30 to 11:30	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17
31175	11	1:30 to 2:30	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17
31176	55	7 to 8:30	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17

Section 1


Joint No.
-53.8
-53.9
-54
-54.1
-54.2
-54.3
-54.4
-54.5
-54.6
-54.7
A-5
A-4
A-3
A-2
A-1
A
A+1
A+2
A+3
A+4
A+5
A+6
A+7
A+8
A+9
A+10
A+11
Pipeline Elevation

Joint No	Total no of defects	Orientation of majority of defects	Stringing	welding	lowering	Hydrotest
33820	156	4 to 5, 7 to 9 & 10 to 11	Mar 16	Apr 16-Feb 17	May 16-Feb 17	Apr 17



Debris analysis

- ✓ Total Debris > 1500 Kgs
- ✓ Presence of moisture- nil
- ✓ Presence of Sulphur- nil.
- ✓ Presence of SRB & TBC- almost nil
- ✓ Presence of Iron- more than 53-55%
- ✓ Corrosion coupons and ER probes reading shows negligible metal loss & corrosion rate.

Major Observation Drawn

- ✓ Internal Corrosion observed prominently at 03 locations in clusters These clusters are located in last 20% of pipeline length. Defects have depth of corrosion between 10-20%.
- ✓ Isolated internal corrosion at random orientation. This may be manufacturing or pre-construction damage.
- ✓ Defects changing orientation from one pipe to the next. This may be corrosion caused during transport or storage.
- ✓ Almost ‘nil’ metal loss of corrosion coupon suggests the corrosion is not active.
- ✓ Gap between stringing & lowering was more than a years for few joints. Similarly, a gap of almost a year for few joints between lowering & hydrotesting.

Recommendations

- ✓ Internally coated pipes should be used as far as possible.
- ✓ Strict adherence to quality assurance plan during construction time.
- ✓ Gap between different construction activities, should be kept possible minimum.
- ✓ Strict acceptable criteria for supply & application of pipe end caps.
- ✓ Ensure testing & treatment of water to be used for hydrotesting
- ✓ Ensure proper drying of the pipeline after hydrotesting
- ✓ Effective cleaning program of the pipeline using cleaning pig runs

Conclusion

- ✓ No evidence of internal corrosion in the pipeline due to the product being transported
- ✓ Corrosion happened in the line is not active now
- ✓ Corrosion might have happened in pipe storage yard or during transportation.
- ✓ Many joints had spent significant duration at pipe mill/ storage yard before stringing. Pattern of orientation of defects suggests the might have corrosion happened before stringing.


Thank You