

AC CORROSION AND ITS MITIGATION-3M's

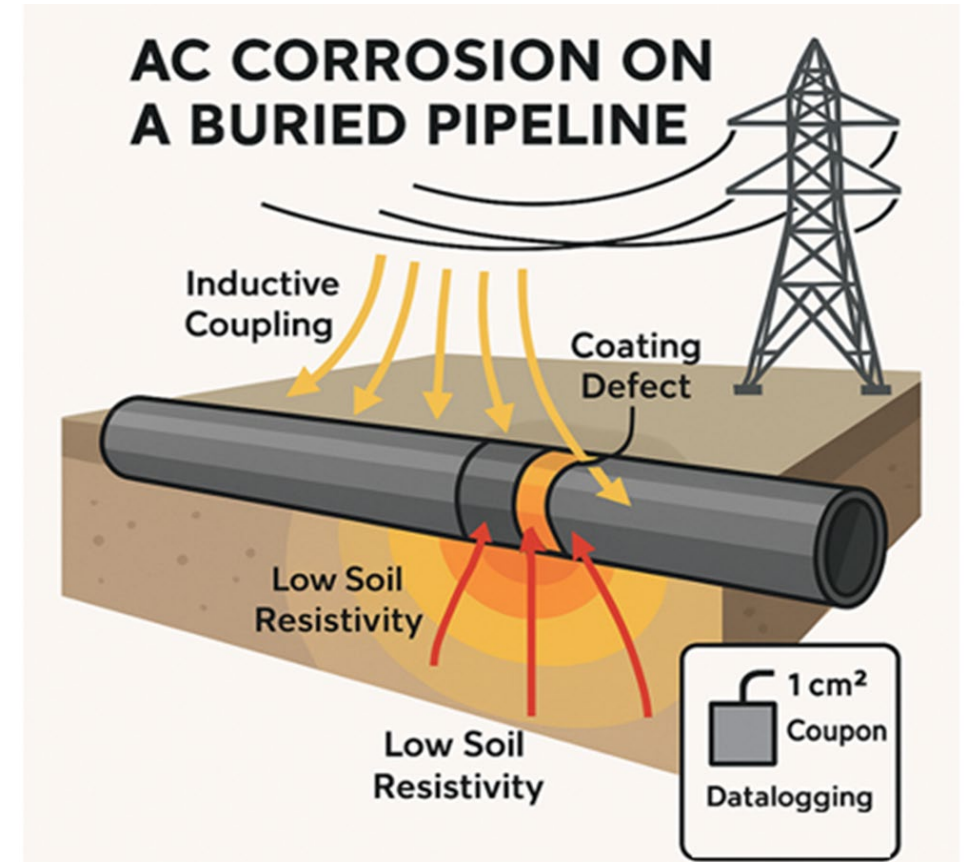
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INTRODUCTION

- The AC Voltage can be imposed on the pipeline due to induction in several ways.
- The primary source of AC interference is adjacent **AC power systems**, such as **high voltage power lines** or AC power systems for **AC-driven trains**. (25KV to 330KV)
- Low Frequency Induction (LFI) /Steady State
- Induced AC leave the pipe, through a defect (usually small defects) in the coating to the soil, low soil resistivity is usually needed to have **AC corrosion**.
- If these conditions are present, even if your pipeline is cathodically protected with a CP system, there is no guarantee that corrosion won't happen.



AC CORROSION CRITERIA

AC VOLTS Criteria

- (a) 4 V a.c. for soil resistivity $\leq 25 \Omega \cdot \text{m}$; and
- (b) 10 V a.c. for soils whose resistivity is $> 25 \Omega \cdot \text{m}$.

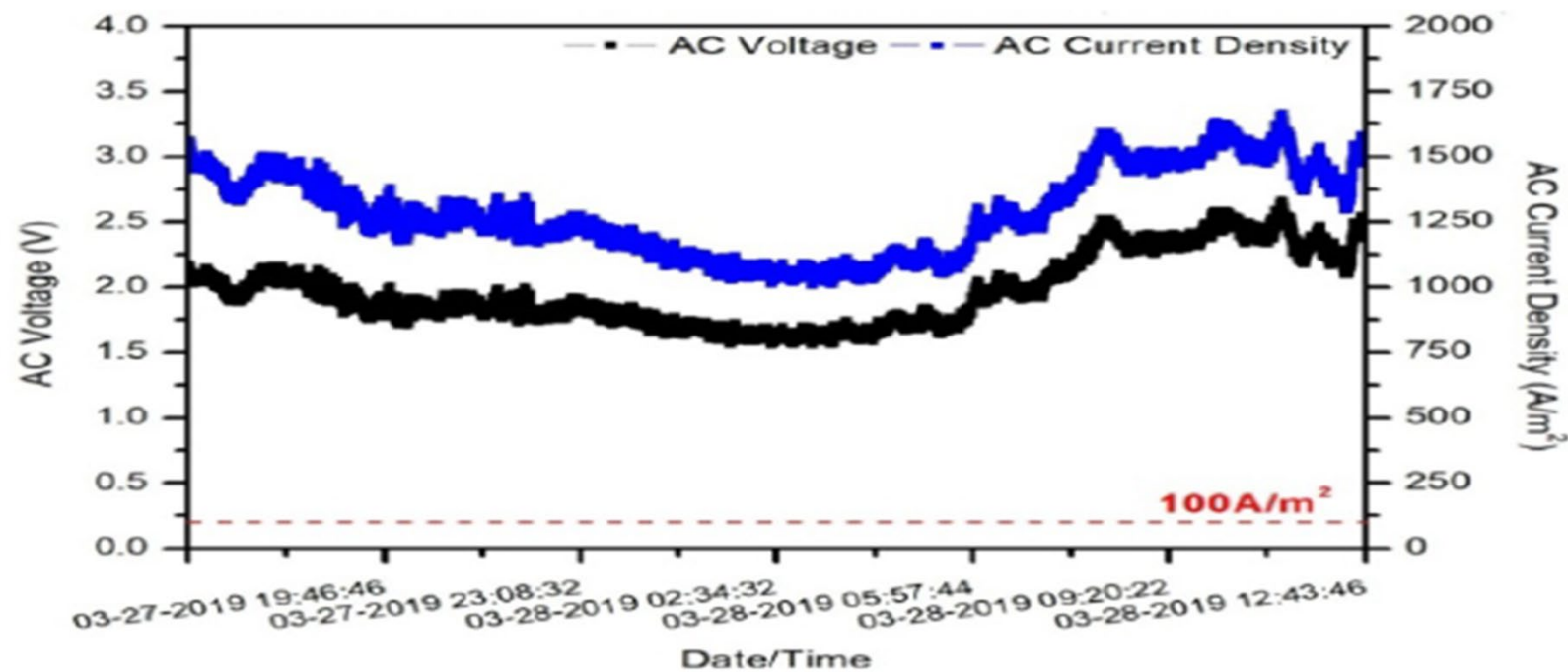
Current Densities Criteria

AC Average Current Density:

Keep the AC average current density below 30 A/m² on a 1 cm² coupon or DC densities below 1 A /m² or AC/DC ratios less than 5

AC CURRENT DENSITIES

- Steady-state voltage alone cannot rule out the AC risk on the metallic mains.
- The main culprit is the AC Current Density.



SOURCE: NACE CP3-2020 MANUAL

Methods and Process

ATCO Gas Australia formulated a process of AC Corrosion risk, which comprises **Model, Monitor and Mitigate (3M's)** and is aligned with Industry standards NACE SP21424-2018 & ISO18086:2019.



- Level one network-wide electrical assessment
- Soil resistivity testing
- Historical AC levels on pipelines

- 1cm² coupon with remote (permanent or temporary) data loggers

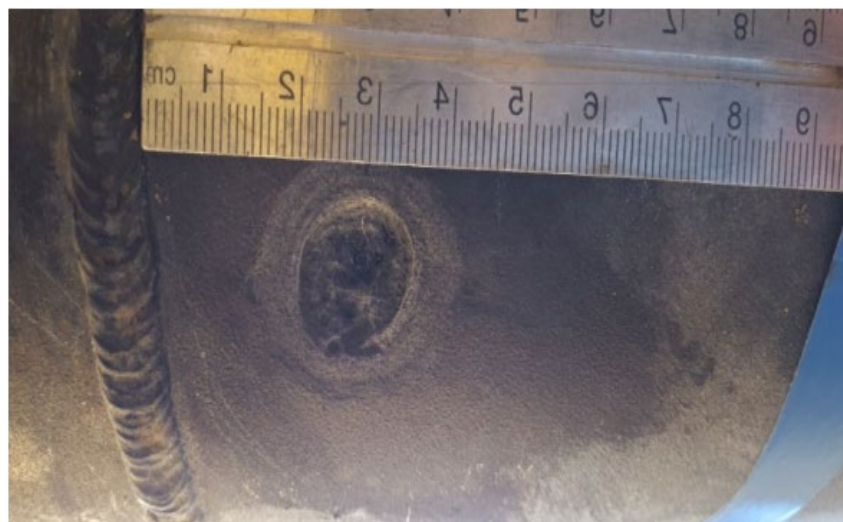
- AC corrosion mitigation design
- Deep or horizontal earthing electrode installation. Continuous monitoring

Case study- Geraldton Gas Pipeline

Pipeline	Attributes
Diameter	150mm
Pipeline length	56180m (56kms)
Coating type	FBE
Material	API 5L grade X46
Wall thickness	6.4mm
Length of parallelism with electrical power lines	5.5Km
Power line load	132kV
Separation distance	15 to 30m
Buried depth	1.2m approx..
Soil resistivity Data	2.8 to 2210 Ω m
Steady state AC Volts	Below 4V
MAOP	6900 kPa g
Cathodic Protection System	Impressed Current Cathodic Protection (ICCP)
Pipeline CP Status	Meeting the -850mV criteria
Age	41 Years



Features of AC Corrosion

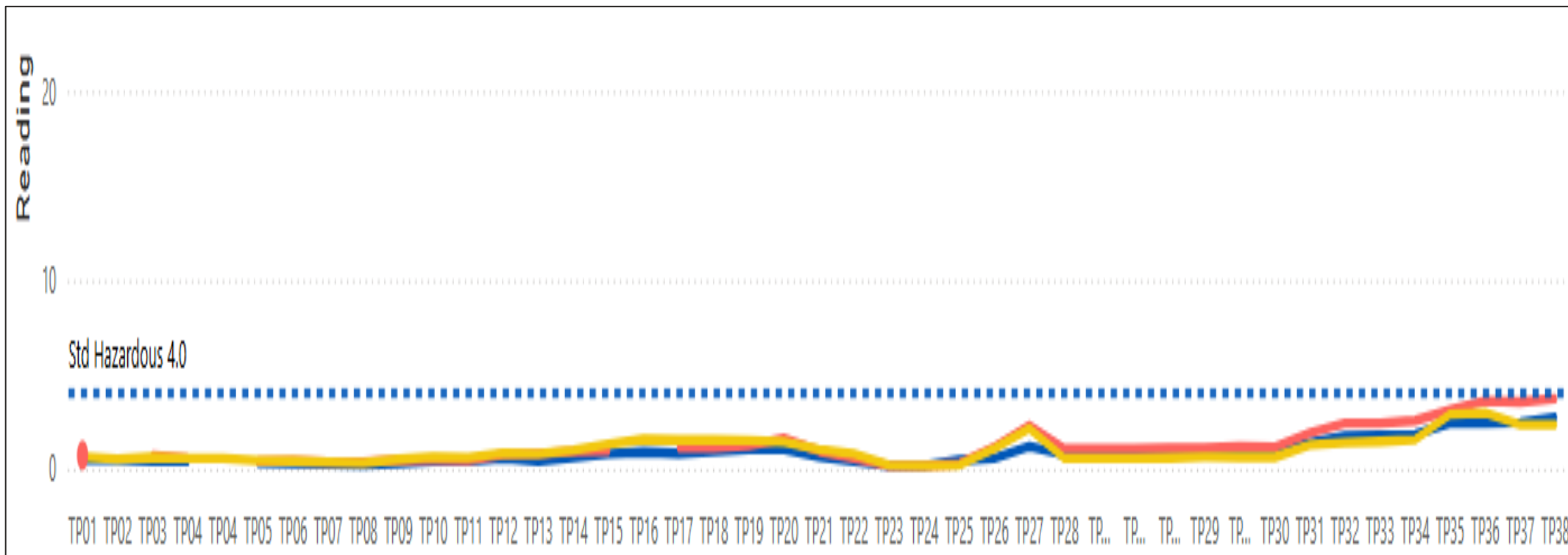


General Corrosion



Steady state AC volts (Analysis)

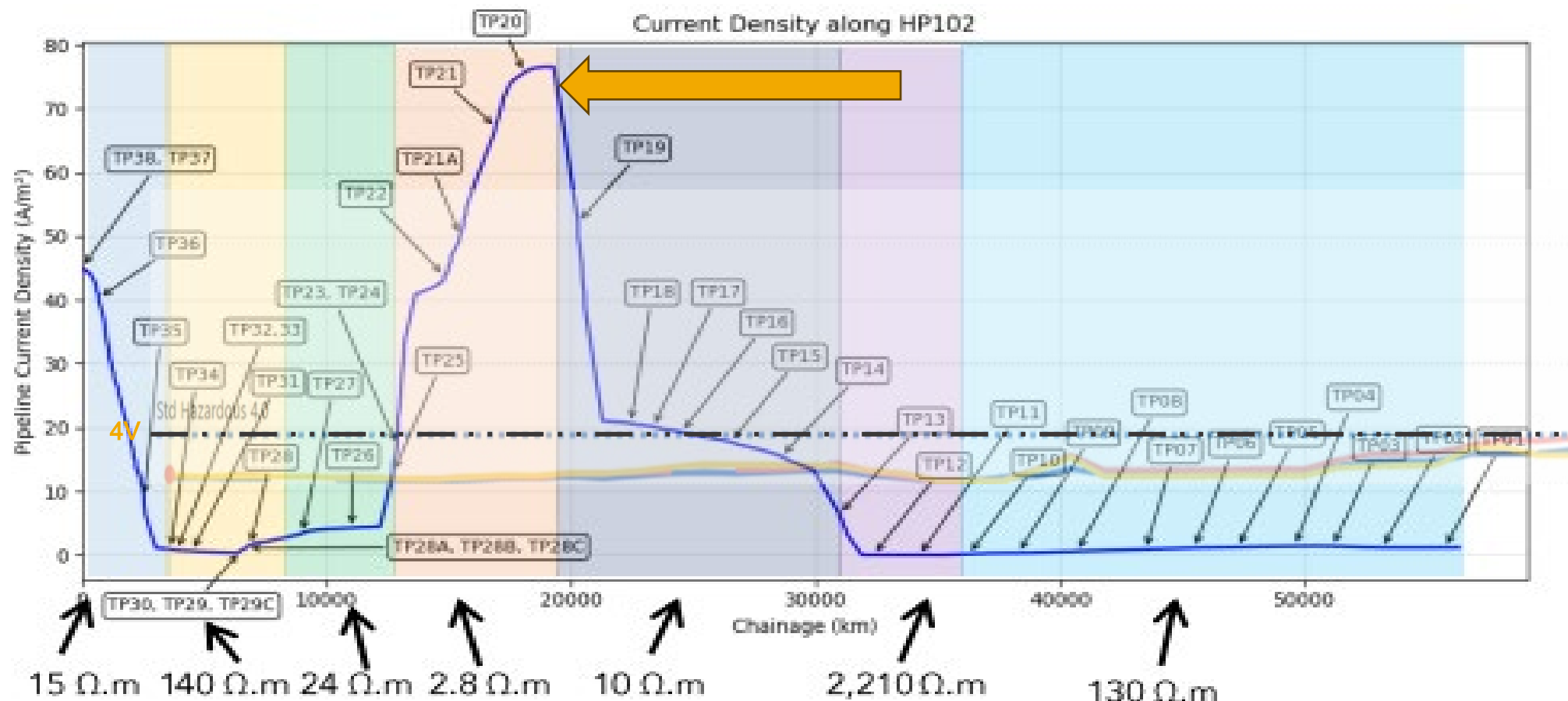
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Modeling (AC Densities)

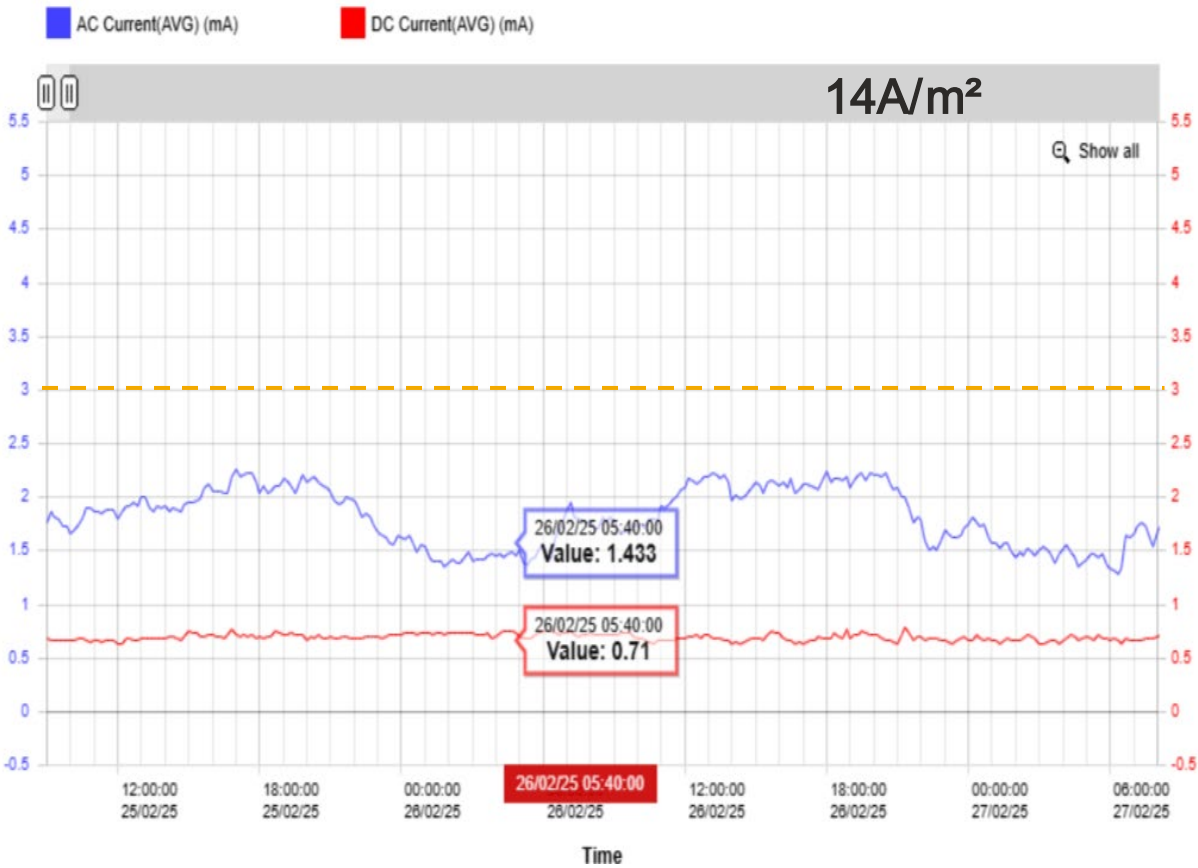
- Can be a desktop model by a corrosion specialist
- Third-party consultant

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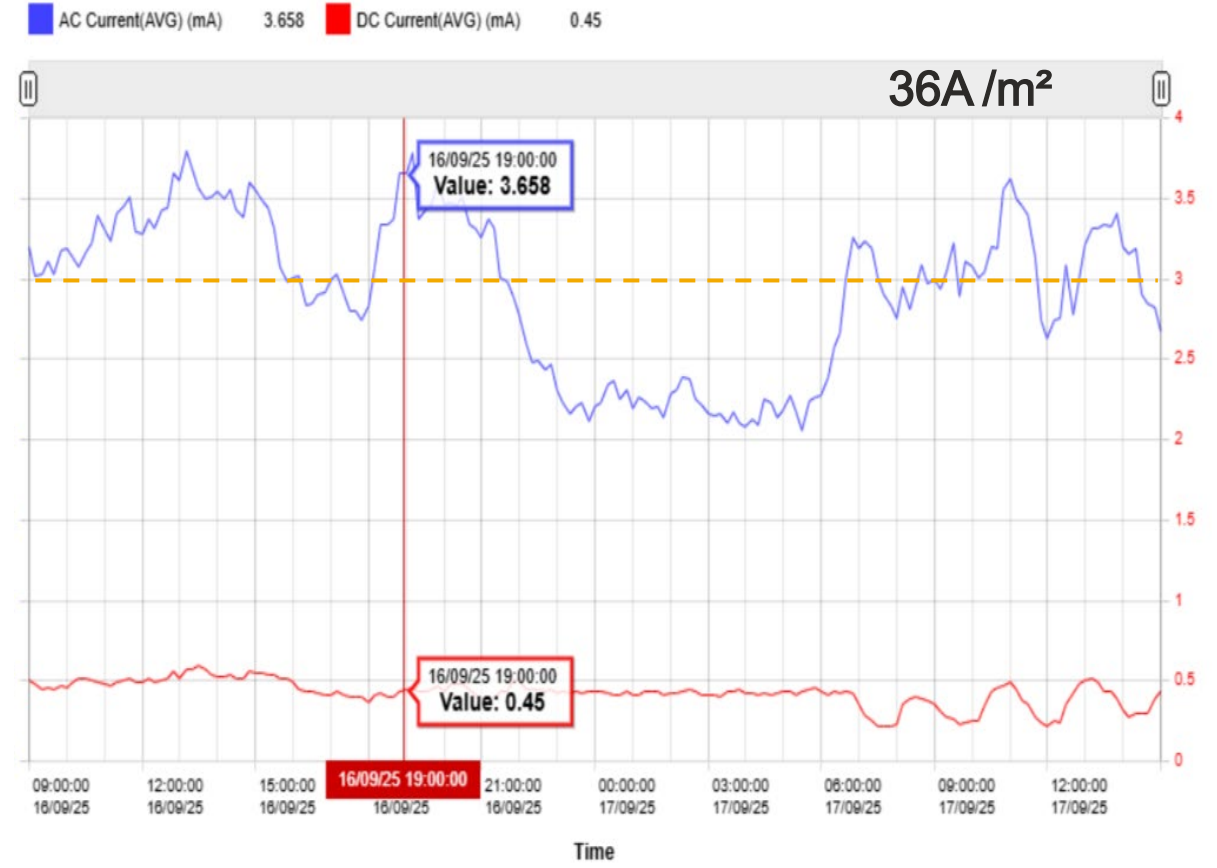


Monitoring (AC Densities)-Realtime via RMU

HP102



Summer



Winter/Spring

Site Photos



This is what you see aboveground

Summary

- AC induction on steel pipelines may cause AC Corrosion
- Local Soil Resistivity, length of parallelism, separation distance & Voltage (load) in the powerline are key parameters
- Current Density is critical, not AC volts alone
- Install AC coupons based on your modelling
- Design mitigation (earthing) based on monitoring real-time data

ATCO Australia

Thank you

Q & A

