Case Study

CableData Monitor™

CableData Monitor™ detects and locates Partial Discharge on cable joints within a petrochemical complex's critical supply cables

Client

- INEOS' Olefins & Polymers (O&P UK) business, which is based at Grangemouth and is one of INEOS' largest manufacturing sites. It is also home to one of Petroineos' oil refineries and oil and gas processing facilities owned by INEOS FPS.

Background

- Any unplanned outage can result in hundreds of thousands of pounds lost revenue and significant additional maintenance / operational costs.
- The company's Combined Heat and Power (CHP) plant supplies electricity to the Grangemouth site through two separate, 1km long, XLPE cable circuits known as CHP1 and CHP2 (Figure 1).
- Following the detection of Partial Discharge (PD) in three relatively new joint-pairs during routine conventional off-line Very Low Frequency (VLF) testing, it was decided to install an on-line permanent cable monitoring system known as the CableData Monitor™ (CDM).

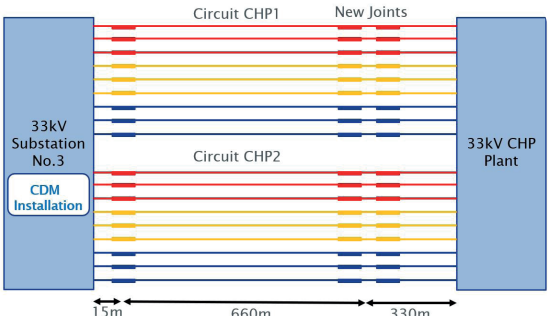

Figure 1
Feeder cable arrangement

Implementation of CableData Monitor™

- EA Technology's CDM provides 24/7 condition monitoring of the critical cables using Radio Frequency Current Transformers (RFCTs) clipped non-intrusively around the earth strap on each of the individual cable terminations within the substation (Figure 2).
- Following installation, the PD activity identified during the VLF testing was confirmed in all three cables using the CDM system and located to the vicinity of the suspect joint-pairs.
- This removed the need to have to take the CHP plant off-line again to perform further periodic VLF testing to determine the severity of the problem.
- Avoiding just a single CHP outage in this way saved considerably more money in terms of lost production than the entire cost of the CDM installation.

Figure 2
RFCT Installation

Implementation of CableData Monitor™ - continued

- The case of cable CHP2-R2 is described here by way of example, but similar results were obtained for the other two cables.
- The onset of PD can be seen in Figure 3 for cable CHP2-R2 over a one-month period when levels rose from 100pC to 1,000pC.
- This highlights the benefit of continuous monitoring whereby trends in activity can be seen that would have been missed with spot measurements alone.
- Precautionary measures were also put in place to ensure that human resources and materials were readily available should there be a sudden unexpected failure.
- All three cables where PD was identified were successfully managed until their joint-pairs were replaced during the planned outage 10 months later.
- The suspect joint-pairs were sent for forensic examination to EA Technology.

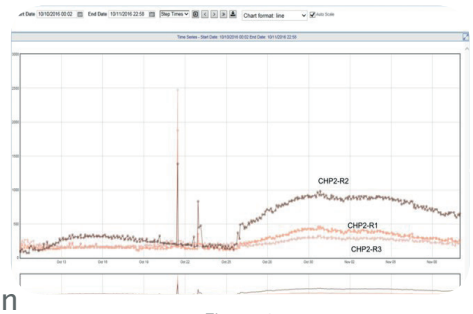

Figure 3
Event Amplitude Mean for cable CHP2-R2

Forensics Investigation Results

- Evidence of PD was found in one joint of the joint-pair when the outer heat shrink cover was removed from the cable stress control sleeve (Figure 4).
- The root cause was identified to be due to an incorrect gap between the XLPE insulation and the connector (only 1mm instead of the recommended 5mm). This prevented the yellow mastic from filling the gap properly, leaving a void that led to the elevated electrical stress responsible for the detected PD.

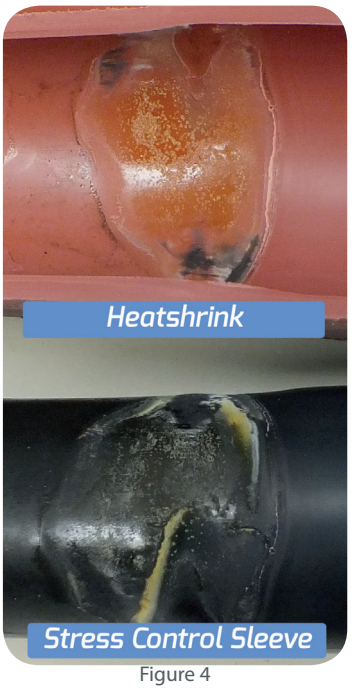

Figure 4
Evidence of PD activity

Conclusion

- If left unattended, this defect would eventually have led to the failure of the joint.
- When the CHP cables were re-energised following the joint replacement, the CDM showed that the PD was no longer present, confirming the successful implementation of the remedial works.
- The CDM system has resulted in considerable financial saving by alleviating CHP plant downtime and is continuing to provide confidence in the integrity of the critical HV cables supplying the site.
- This study has shown how INEOS' pro active approach to managing PD on its critical HV cables has helped to save money, whilst at the same time, enhance the reliability of its electricity distribution network at its site at Grangemouth.
- The system has since been expanded to monitor all 120 cables in the primary substation.

Figure 5
Cause of PD activity

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