

# **Minutes of EFC WP15**

## **Corrosion in the Refinery and Petrochemical Industry**

**Dalmine (Italy)**  
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### Acknowledgement

The EFC WP 15 Refinery Corrosion Group would like to express thanks to Tenaris for hosting this meeting in Dalmine with special thanks to Luna Fullin and Giacomo Marcolin for organizing the meeting.

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## 1 Welcome & Introduction

Luna Fullin and Giacomo Marcolin welcomed the participants in the name of Tenaris. They presented Dalmine plant that employs 1500 persons and produces 800 000 tons of steel per year. Dalmine plant is dedicated to the production of medium and large pipes for the energy sector and other industrial applications. A visit of the plant took place after the meeting.

After this introduction, the 40 persons attended the meeting briefly introduced themselves. The list of the participants is enclosed in Appendix 1.

## 2 EFC WP15 Activities

### 2.1 EFC WP15 Activities & Minutes of Meetings

Information about the activities of EFC WP15, Corrosion in the Refinery and Petrochemistry Industry was presented by Francois Ropital. This information can also be found on the EFC WP15 website, where the minutes of previous WP15 meetings minutes can be viewed and downloaded. More information is enclosed in Appendix 2.

### 2.2 Publications

The following publications from WP15 are available:

- EFC Guideline no. 40: Prevention of Corrosion by Cooling Waters
- EFC Guideline no. 42: A Collection of Selected Papers
- EFC Guideline no. 46: Amine Unit Survey. This topic is the object of a task force to publish a new guideline on this topic
- EFC Guideline no. 55: Corrosion under insulation (CUI) guidelines: the updated version has been published in December 2005

Discussion on proposals for future publications:

- A best practice guideline on corrosion in sea water cooling systems is proposed. It could be managed in relation with EFC WP9 "Marine corrosion"
- Best practice guideline to avoid and characterize stress relaxation cracking.

### 2.3 Next Meetings & Conferences

*Eurocorr 2018 (Krakow, Poland)*

The next Eurocorr-conference "Applied science with constant Awareness" will take place in Krakow, Poland from 9-13 September 2018. On Monday 10 September the corrosion in refinery and petrochemical industry session will take place.

<http://eurocorr.org/EUROCRR+2018.html>

The next WP15 business meeting will take place during the Eurocorr 2018 conference in Krakow, most probably on Tuesday 11<sup>th</sup> September 2018 afternoon (to be confirmed).

*2019 Conferences*

- NACE CORROSION 2019: 24 – 29 March 2019 (Nashville, USA)
- EUROCORN 2019: 8 – 13 September 2019 (Seville, Spain)
- EUROCORN 2020: 6 – 10 September 2020 (Brussels, Belgium)

### **3 Advancement of task force on corrosion in sour gas amine unit's treatment**

The progress of the amine corrosion Taskforce can be described as slow but steady forwards. After September some questionnaires with corrosion experience were returned. In March the Taskforce had a teleconference and at least one teleconference will be held before the Eurocorr in September. Besides that the obtained corrosion experience data will be compiled and analysed, the Taskforce also started working on updating and extending the text of the publication.

### **4 THOR™ 115 – New ferritic steel with improved oxidation and sulfidation resistance**

Luna Fellin (Tenaris) presented the development of a new 11% Cr ferritic stainless steel that has an improved steam oxidation resistance and better creep properties than 91 grades. Its resistance to sulfidation, naphthenic acid and chloride induced corrosion has also been evaluated. More information can be found in Appendix 3.

### **5 Testing of a material under HDT condition of a refinery**

The sulfidation processes were presented by Mabruk Suleiman (Adnoc). A focus was done on active sulphur compounds. Corrosion tests results at 390 and 420°C in a pilot HDT device, obtained for the new ferritic THOR 115™ were also discussed. More information can be found in Appendix 4.

### **6 Material selection for heat exchanger tubes in oil refineries**

Alessandra Spaghetti (Sandvik) presented corrosion results for the application of duplex and austenitic stainless steels (25-07, 27-07HD, Sanicro 28 and 41) for different refinery applications of heat exchangers. More information can be found in Appendix 5.

### **7 Corrosion during water washing of CDU overheads**

Marco De Marco (Istituto Italiano della Saldatura) reported the different potential damages that can be related to water washing in CDU overheads. Two failure cases were also presented. More information can be found in Appendix 6.

### **8 Disruptive solution for amine vessel corrosion protection**

Fred van Rodijnen (Oerlikon Metco Europe GmbH) presented the evolution of his company by the acquisition of Scoperta company that via a modeling tools, develops new advanced materials. A new thermal spray coating (that has a 2.8% closed porosity) is under corrosion evaluation in different corrosive media and compared with C276 alloy.

## **9 Advancement of the development of a methodology to characterize Stress Relaxation Cracking**

Martin Monnot reported the advancement of the work performed by Industeel in order to develop an effective and reliable stress relaxation cracking test. The 4 point bending tests configuration was not successful and has been replaced by U bend tests on 15 mm thick specimens (tests are still ongoing). More information can be found in Appendix 7.

## **10 Non-destructive inspection through insulated systems**

Calum White (Kaefer Isoliertechnik) presented 2 non-destructive techniques: OpenVision and Eddyfi Lyft. OpenVision is a portable fluoroscopic (RTR) low voltage X-ray inspection tool that can inspect through cladding and insulation and image the pipe wall surface, showing areas of potential CUI or contaminated insulation. Eddyfi Lyft is based on Pulsed Eddy Current (PEC) that induces powerful magnetic force into the test item through cladding and insulation and it can evaluate average remaining wall thickness over an area. More information can be found in Appendix 8.

## **11 Sulfide Stress Corrosion Cracking on dissimilar 625/carbon steel welds**

Marco De Marco (Istituto Italiano della Saldatura) reported a SSC failure case in a gas treating plant after 60 days due to dissimilar welds of carbon steels with Inconel 625 filler alloy. The crack followed the fusion line where peaks of increased hardness were measured. Post Weld Heat Treatments (PWHT) cannot relieve hardness peaks in dissimilar CRA/CS welds. More information can be found in Appendix 9.

## **12 Opportunity Crude Processing and Optimized Blend Management with Crude Corrosivity Prediction System**

Slawomir Kus presented Honeywell JIP phase 3 on the management of naphthenic acids containing crudes that will start this year. The previous phases were focused on a static approach for corrosion mapping of blended crudes. The new phase will be based on a real-time approach for online prediction. More information can be found in Appendix 10.

## **13 Corrosion under pipe supporting**

Sebastian Tarentino (Sitech) and Gino de Landtsheer (Borealis) presented a strategy for risk assessment, detection and repair for corrosion under pipe supports (CUPS). Recommendations to prevent CUPS are also proposed. More information can be found in Appendix 11.

## **14 JIP proposal corrosion under insulation on**

Johan Sentjens (Temati) presented a JIP proposed by Southwest Research Institute (San Antonio – Texas). This JIP contains 4 tasks: refining test procedure, selection of coatings and insulation combinations, tests, development of durability predictions. More information can be found in Appendix 12.

## **15 Experiences of MIC damage occurred under non-operating conditions**

Mirko Arzuffi (Amec Foster Wheeler – Wood Group) reported 3 failure cases due to Microbiological Induced Corrosion of stainless steels, related to surface treatment, hydrotest operations or transportation. More information can be found in Appendix 13.

## **16 Failure cases**

Raffaele Torella (Rina consulting) reported several failures cases analysis.

## **17 Influence of fluorides leak on cooling system corrosion (case study)**

A carbon steel cooling water corrosion case was reported by Valerie Bour-Beucler (Nalco-Champion). Several causes led to this corrosion: non-passivation of the carbon steel, contamination by fluoride and SRBs in the cooling water. More information can be found in Appendix 14.

## **18 Open discussions**

A forum of discussion took place at the end of the meeting on the following topics:

- Use of continuous thickness monitoring for corrosion prevention (Giovanna. Gabetta – Eni)
- Wrapping temporary repairs (Matteo Poldi - Eni)
- Fitness For Services and Residual Life Assessment (Antonio Lucci - Rina)