

**Minutes of EFC WP15  
Corrosion in the Refinery Industry**

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**Acknowledgement**

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## **1 Welcome & Introduction**

Dechema presented some of its activities. One of them is the development with Knovel of a new corrosion content strategy that would include enhancing DECHEMA Corrosion Handbook data. A survey is in progress and more information is enclosed Appendix 1

After this introduction, the 25 persons attended the meeting briefly introduced themselves. The list of the participants is enclosed in Appendix 2.

## **2 EFC WP15 Activities**

### **2.1 EFC WP15 Activities & Minutes of Meetings**

Information about the activities of EFC WP15, Corrosion in the Refinery 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 3.

### **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 (see paragraph)
- 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". This topic could be also proposed as a joint session WP9-WP15 for a next Eurocorr conference.
- Degradation and reparation of GRP pipelines. This could be managed in relation with EFC WP19 "Corrosion in polymer materials".

### 2.3 Next Meetings & Conferences

#### *Eurocorr 2017 (Prague, Czech Republic)*

The next Eurocorr-conference "Corrosion control for safer living" will take place in Prague, Czech Republic from 3-7 September 2017. This conference will be associated with the 20<sup>th</sup> International Corrosion Congress (ICC) and the Process Safety Congress. On Tuesday 5 September afternoon and Wednesday 6 morning the corrosion in refinery session will take place.

<http://eurocorr.org/EUROCORN+2017 +20th+ICC+ amp +Process+Safety+Congress+2017-p-71180.html>

The next WP15 business meeting will take place during the Eurocorr 2017 conference, most probably on Wednesday 6<sup>th</sup> September 2017 morning after the Refinery Corrosion Session (to be confirmed).

#### *2018 Conferences*

- NACE CORROSION 2018: 15 – 19 April 2018 (Phoenix, USA)
- EUROCORN 2018: 9 – 13 September 2018 (Krakow, Poland)

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

Johan van Roij reported on the activities of the task force that works on the update the "Amine unit Corrosion in Refineries", EFC publication 46. A questionnaire for a survey has been distributed in December 2016 but due to the lack of responses, the deadline is postponed by the end of 2017. The content of the document with revision – addition of updated chapters is in progress.

### 4 Premature failure of waste heat boiler super-heater tubes

Mabruk Suleiman (Takreer) presented the failure of 304H tubes of a waste heat boiler in an H<sub>2</sub>SO<sub>4</sub> alkylation unit. Stress corrosion cracking due to chlorides seems to be the corrosion mechanism. The source of chlorides has been investigated: from the hydrostatic test water, injection of chemicals?

### 5 Austenitic stainless steel bismuth-free flux-cored wires for high-temperature applications

Francesco Ciccomascolo (Voestalpine Böhler Welding) presented new bismuth-free flux cored wires for joining and overlay welding and their comparison to conventional wires. The Bismuth-free wires showed improved resistance to embrittlement after PWHT at 700°C and higher impact toughness. Hot tensile tests confirmed significantly higher elongation values for the bismuth-free wires. Welding and slag removal is equal to the standard wires. More information can be found in Appendix 6.

## **6 Stainless steel bundle failure**

Matteo Poldi (Eni) reported the failure of 316L stainless on the shell of bundle that was in contact with light condensates. The chloride stress corrosion cracking was active during the three unplanned shutdown events. The rupture appeared after one month. More information can be found in Appendix 5.

## **7 Cracks in dissimilar welds at primary reformer outlet**

Matthias Gierlinger (Borealis) presented the cracking of several welds between 36X and 15Mo3 steels in primary reformer outlets. The likeliest failure root cause is identified as condensation at the welds leading to carbonic acid corrosion with partial hydrogen cracking on the 15Mo3 side of the weld as well as stress corrosion cracking from accumulation of process impurities in the stainless materials (weld metal and 36X close to the weld). Crack propagation is expected mainly during shut down due to the induced tensile load during the contraction of the materials and the embrittlement effect at decreased temperature. More information can be found in Appendix 6.

## **8 Failure of stripper feed/bottom heat exchanger tubes in a naphtha hydrotreatment unit**

Francois Dubois (Axens) reported the failure of a 304L stainless steel heat exchanger (that replaces a carbon steel one) in a naphtha hydrotreatment. Several mechanisms contributed to the failure: chloride SCC, wet H<sub>2</sub>S SCC, pits, differential thermal dilatation and constrains during operation. It has been decided to switch back to carbon steel bundle that suffers only rapid generalized corrosion. Alternate material (Ni-Cr-Mo) is also considered. More information can be found in Appendix 7.

## **9 New corrosion inhibitors for cooling water systems**

Valerie Bour-Beucler (Nalco-Champion) detailed the development of new high charge polymers (HCP) to inhibit corrosion in cooling water systems. Some cases of applications have also been presented. More information can be found in Appendix 8.

## **10 Discussion about corrosion in cooling water systems as a result of poor water treatment**

Gino De Lantsheer (Borealis) presented the point of view of the user of cooling water inhibition systems. Strong interactions between plant commercial services, operators and inhibitors suppliers are necessary. More information can be found in Appendix 9.

## **11 Discussion - Guidelines for pipes stocking before pre-fabrication and installation**

Giacomo Marcolin (Tenaris Dalmine) launched a discussion on pipes stocking conditions before pre fabrication and installation. The proposal of a guideline that could include a list of recommendations and some examples of failures has been submitted.

## **12 Developing guidelines and initiatives towards an holistic kind of approach to the CUI problem**

Michelle Mannucci (Termisol Termica) and Thomas Rehberg (Kaefer) gave for FESI an overview on some existing guidelines on protective coatings to prevent corrosion under insulation. The holistic approach of the FESI interactive selection system (FISS) against CUI has been presented. More information can be found in Appendix 10.

## **13 Status of monitoring and detection procedures/techniques to detect CUI mitigating CUI, ones discovered, how to challenge, to challenge and to follow-up. Integration of mitigated CUI areas in RBI systems, how to re-evaluate?**

Gino De Lantsheer (Borealis) presented an end-user roadmap to manage CUI. Preventing and tackling actions have been highlighted. More information can be found in Appendix 11.

## **14 High quality electroslag strip cladding of thin single layer for 625 alloy**

Francesco Ciccomascolo (Voestalpine Böhler Welding) presented a new electroslag strip cladding process (ESSC) for 625 alloy single layer. This new ESSC strip / flux solution account for major time savings and its satisfies mechanical and corrosion requirements laid down in various standards relevant to the industry. More information can be found in Appendix 12.

## **15 Open discussions**

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

- Wet H<sub>2</sub>S service in refineries (J. van Roij – Shell)
- Innovative ways to perform inspection (M. Poldi – Eni)
- Corrosion topics in green refinery (G. Gabetta – Eni)
- Amine system corrosion (R. Brandl – OMV)
- Polythionic acid corrosion of Inconel 625 (M. Suleiman – Takreer)
- Temporary protection of pipelines (L. Renaud – Total)
- Corrosion of 904L stainless in sulphuric acid alkylolation unit (L. Renaud – Total)