

Minutes of EFC WP15
Corrosion in the Refinery and Petrochemical Industry

Roma (Italy)
10 April 2019

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Acknowledgement

The EFC WP 15 Refinery Corrosion Group would like to express thanks to Rina-CSM for hosting this meeting in Roma with special thanks to Antonio Lucci for organizing the meeting.

Contenu

1	Welcome & Introduction	3
2	EFC WP15 Activities	3
2.1	EFC WP15 Activities & Minutes of Meetings.....	3
2.2	Publications	3
2.3	Next Meetings & Conferences	4
3	Advancement of task force on corrosion in sour gas amine unit's treatment	4
4	Advancement of task force on revision of the EFC CUI guideline	4
5	Recent lean amine (alkaline) stress corrosion cracking experiences	4
6	Permasense monitoring for amine units	5
7	Use of new sensors techniques to detect CUI	5
8	New array sensor for Pulsed Eddy Current testing.....	5
9	High Temperature Hydrogen Attack management within Total	5
10	High Temperature Hydrogen Attack in carbon steels overview and initiative at TWI	5
11	TWI experience regarding stress relaxation cracking	6
12	Stress relaxation cracking : a design or metallurgical issue.....	6
13	Biodetergent as part of the cooling water system treatment to have a better legionella control	6
14	Stress corrosion cracking of stainless steels under insulation.....	6
15	Influence of ferrite content on Sulfide Stress Corrosion of duplex stainless steel.....	6
16	The impact of process fouling on the oxidation of steam super heater	6
17	Unusual cracking in stripper section of HDS Units	6
18	Analysis of Corrosion Damage in a Refinery Regeneration Circuit Tube	7
19	Open discussions	7
20	Next Meeting	7

1 Welcome & Introduction

Antonio Lucci welcomed the participants in the name of Rina-CSM. He presented the Rina company that provides a wide range of services across the Energy, Marine, Certification, Transport & Infrastructure and Industry sectors through a global network of 170 offices in 65 countries. Rina employs 3700 persons and has a revenue turnover of 437 M€ in 2018. More information can be found in Appendix 1.

After this introduction, the 50 persons attending 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 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 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 (coordinator: Johan van Roij)
- EFC Guideline no. 55: Corrosion under insulation (CUI) guidelines. The second revision of this guideline is the object of a specific task force (coordinator: Gino de Landtsheer).

In relation with EFC WP9 "Marine corrosion", another taskforce has started in order to publish a best practice guideline on corrosion in sea water cooling systems (coordinators: V. Bour-Beucler, F. Ropital).

2.3 Next Meetings & Conferences

Eurocorr 2019 (Seville, Spain)

The next Eurocorr-conference "New times, new materials, new corrosion challenge" will take place in Seville, Spain from 9-13 September 2019. On Thursday 12 and Friday 13 September the corrosion in refinery and petrochemical industry session will take place.

<https://eurocorr.org/EUROCORN+2019.html>

The next WP15 business meeting will take place during the Eurocorr 2019 conference in Seville, most probably on Wednesday 11th September 2019 afternoon (to be confirmed).

2020 Conferences

- NACE CORROSION 2020: 15 – 19 March 2020 (Houston, USA)
- EUROCORN 2020: 6 – 10 September 2020 (Brussels, Belgium)
- EUROCORN 2021: 19 – 23 September 2021 (Budapest, Hungary)

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

The EFC WP13-WP15 amine corrosion Taskforce has the objective to update publication 46. For that a literature survey and an industry survey were performed to obtain the current experiences in amine treating units. Currently the Taskforce is processing the obtained information and a start is made to update and rewrite the Publication 46. On April 9, 2019, a Taskforce meeting (face to face F2F and Skype) was held at Rina-CSM Consulting in Roma. In the meeting the content of the book was discussed including who are the main writers and reviewers per chapter. The current target timeline is: First draft Chapter ready: end of June. Teleconference end of June/early July. Finish draft chapters end of August. During Eurocorr (September 2019) a Taskforce F2F and Skype meeting to check content / progress and gap analyses. End of 2019 draft publication ready. 2020 issuing new Publication 46: Amine corrosion in refineries and Oil and Gas production.

4 Advancement of task force on revision of the EFC CUI guideline

This taskforce had several Skype meetings and a face to face on 9th April in Rina facilities in Roma. Proposals of chapters updates have to be done before Eurocorr 2019 in order to be validated. Then they will be sent to the publisher in January 2020 for an issue of the revised green book for Eurocorr 2020.

5 Recent lean amine (alkaline) stress corrosion cracking experiences

Sophie Loyan (Total Refining and Chemicals) reported several alkaline stress corrosion cracking damages in DEA lean amine tank, heat exchangers and pipings. The leaks were difficult to find

and identify. The original PWHT was not a guarantee to avoid ASCC. Hardness measurements were not representative of the residual tensile stresses. More information can be found in Appendix 4.

6 Permasense monitoring for amine units

Some applications of Permasense ultrasonic sensors for monitoring amine units were presented by Peter Fischbacher (Emerson Automation Solutions). This monitoring technique enables engineers to reliably determine if corrosion is taking place, to understand the correlation between corrosion rates and process conditions and to optimize the corrosion prevention and mitigation measures. More information can be found in Appendix 5.

7 Use of new sensors techniques to detect CUI

Gino De Landtsheer (Borealis) reported the development by iSenspro of a new technique based on a capacitor sensor, to continuously detect corrosion under insulation damages. The sensor is mounted outside the insulation and it allows a 360° detection over a 6 m segment. More information can be found in Appendix 6.

8 New array sensor for Pulsed Eddy Current testing

For mainly CUI or Flow Induced corrosion detections, Eddyfi is developing an improved pulsed eddy current array sensor for ferromagnetic materials through up to 300 mm thickness of insulation, coating or supports. Casper Wassink (Eddyfi Technologies) presented some examples of improved productivity and performances of this new sensor. More information can be found in Appendix 7.

9 High Temperature Hydrogen Attack management within Total

For HTHA management, TOTAL has developed a guideline that integrates a methodology for the inventory of equipment and piping that might be subject to HTHA, that ranks equipment and piping function of HTHA severity based on Nelson curves, that defines the inspection plans function of HTHA severity and that gives criteria for replacement. Sophie Loyan presented also the development of improved UT techniques to detect HTHA damages. More information can be found in Appendix 8.

10 High Temperature Hydrogen Attack in carbon steels overview and initiative at TWI

John Rothwell (TWI) presented a review of TWI activities in the field of HTHA, which include a Review of NDE and metallurgical aspects for the UK health and safety executive, production of crack growth data, and validation of NDE and assessment methodologies on a hot hydrogen pressure vessel. The outline of a new JIP proposal to validate leading NDT technologies for the detection of HTHA in welded carbon steel components is gathering momentum and will be launched this year. More information can be downloaded with the following link: <https://www.twi-global.com/pdfs/Joint-Industry-Projects/PROP302145-Project-Outline-Final.pdf.pdf>.

11 TWI experience regarding stress relaxation cracking

Imran Bhamji (TWI) gave a presentation on TWI experiences and activities related to SRC, and presented some data suggesting that the failure mechanism might be related to a combination of grain boundary oxidation, as well as applied load. He then gave some information regarding a TWI JIP entitled: 'Assessment and prediction of Stress Relaxation Cracking'. More information on the JIP can be downloaded with the following link: <https://www.twi-global.com/pdfs/Joint-Industry-Projects/prop304497-project-outline-2.pdf>

12 Stress relaxation cracking : a design or metallurgical issue

Marco De Marco (Istituto Italiano della Saldatura) reported recent SRC failure cases. The different parameters that affect SRC were reviewed. More information can be found in Appendix 9.

13 Biodetergent as part of the cooling water system treatment to have a better legionella control

Valerie Bour-Beucler (Nalco-Champion) emphasized the impact of biodetergents combined to biocides, on the cooling water treatment efficiency. Some recent field cases confirm that biodetergents should be considered as a best practice associated to the biocides to have microbiological phenomena under control. More information can be found in Appendix 10.

14 Stress corrosion cracking of stainless steels under insulation

A CUI failure case was reported by Swen Koller (Holborn Europa) on a MEA regenerator built in 1979 with AISI 321 stainless steel. Laboratory examinations revealed a stress corrosion cracking propagation phenomena. More information can be found in Appendix 11.

15 Influence of ferrite content on Sulfide Stress Corrosion of duplex stainless steel

Martin Monnot (Industeel) presented a study on the effect of ferrite content on stress corrosion cracking of 22-05 duplex stainless steels in sour environments. Gleeble specimens were prepared and tested under tensile slow strain rate conditions at 90°C. High ferrite content (74%) samples were clearly more sensitive to stress corrosion than low ferrite content (58%). More information can be found in Appendix 12.

16 The impact of process fouling on the oxidation of steam super heater

Fouling of a P22 crude unit was reported by Mabruk Suleiman (ADNOC). An overheat occurred due to bad heat transfer induced by coke deposition. High temperature oxidation phenomena appears to be the main cause of the P22 corrosion.

17 Unusual cracking in stripper section of HDS Units

Marco De Marco (Istituto Italiano della Saldatura) reported two failure cases in the stripper section of HDS units. The cracks affecting the investigated samples started from the inner

surface of the component and were localized at welds: an alkaline stress corrosion mechanism is suspected. More information can be found in Appendix 13.

18 Analysis of Corrosion Damage in a Refinery Regeneration Circuit Tube

In last years a catalyst regeneration circuits had experienced internal corrosion damages, in particular in dead zones near valves. Ali Smith (Rina) reported the investigations on a sample of P11 tubing from the regeneration circuit: HCl acid dewpoint corrosion appeared to be the cause of the damages. More information can be found in Appendix 14.

19 Open discussions

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

- Specification for fine grained pressure vessel steel adapted to sour service conditions (S. Koller - Holborn Europa)
- Update on the Dutch JIP on CUI inspection currently running within the World Class Maintenance consortium, sponsored by the Dutch chemical industry association and the Dutch government
- Corrosion troubles with opportunity crudes (Mabruk Suleiman)

20 Next Meeting

2019 Autumn Full WP 15 Meeting:

This meeting will take place in Seville, Spain during Eurocorr from 9-13 September 2019.