

Minutes of EFC WP 15

Corrosion in the Refinery Industry

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1 Welcome

The meeting was opened by Francois Ropital.

35 persons attended the meeting and briefly introduced themselves. Apologies were received from 9 persons. The lists of the participants and the excused persons are enclosed in Appendix 1.

2 EFC WP 15 Activities

2.1 EFC WP 15 Activities and Minutes of Meetings

Information on the activities of EFC WP 15, Corrosion in the Refinery Industry, was presented by Francois Ropital. This information can also be found on the EFC web-site where the minutes of previous WP15 meetings can be consulted and downloaded. More information is enclosed in Appendix 2. More information can also be found on our web site:

<http://www.efcweb.org/Working+Parties-p-104085/WP+15-p-104111.html>

2.2 Publications from WP15

The following publications are available:

- EFC Guideline no. 40: "Prevention of Corrosion by Cooling Waters"
<http://www.woodheadpublishing.com/en/book.aspx?bookID=1193>

An update of this document has been prepared in order to publish a joint NACE – EFC guideline on the topic. More information on this project is provided in section 2.4.

- EFC Guideline no. 42: Corrosion in refineries
<http://www.woodheadpublishing.com/en/book.aspx?bookID=1295>

This is a collection of selected papers from previous Eurocorr sessions.

- EFC Guideline n°46: "Amine Unit Corrosion Survey"
<http://www.woodheadpublishing.com/en/book.aspx?bookID=1299>

- EFC Guideline n°55: "Corrosion under insulation CUI guidelines"
<http://www.woodheadpublishing.com/en/book.aspx?bookID=1486>

More information on the availability of these EFC guidelines and how to order these can be obtained with the following web link:

<http://www.woodheadpublishing.com/en/search.aspx?basic=EFC>

Discussion on proposals for future publications:

- A collection of selected papers from the Eurocorr 2005 and 2008 workshops on the corrosion by naphthenic acids will be evaluated, regarding the pertinence of the proceedings papers.
- Regarding the advancement of the Cefracor group on the subject (see paragraph 6) a best practice guideline to avoid and characterize the high temperature stress relaxation cracking of stainless steels.

2.3 Collaboration with NACE

Opportunities for collaboration between EFC and NACE are fully supported by the board of administrators of the two associations.

2.3.1 Exchange of information

Exchange of information between WP15 and the NACE groups dedicated to the same topics are encouraged. Rob Scanlan will continue to be the EFC WP15 representative for the NACE meetings during the annual NACE Conferences to inform on the WP15 activities.

2.3.2 Joint publication on cooling water with EFC WP1 and NACE TG151, TG152, TG361 groups

The elaboration of common guidelines between NACE and EFC is also an objective of the collaboration between the two associations. On the cooling water treatment topic, a task force that has been launch to get a common document between NACE report 11106 "Monitoring and adjustment of cooling water treatment operating parameters", NACE report 11206 "Biocide monitoring and control in cooling towers" and the EFC 40 guideline "Prevention of corrosion by cooling waters" has finalized the new publication that will be printed by the end of 2008.

2.3.3 Joint NACE EFC congress on corrosion in refineries in June 2010

During meetings between NACE and EFC presidents and vice presidents in New Orleans and Edinburgh, it was suggested that it may be possible for NACE and EFC to cooperate over the organisation of one conference in Europe. The theme of corrosion in refineries has been selected because it could attract many participants from USA, Europe and the Middle East. In order to get enough delay for the organisation and to avoid to much proximity with the annual NACE conference and the EFC Eurocorr, the period around June 2010 has been proposed and the location close to refineries suggested (Amsterdam, Lyon, ...). The conference should be co-chaired by EFC WP15 (F. Ropital, H. de Bruyn) and NACE STG 34 (C. Laughlin to be confirmed). Rob Scanlan and John Wodarczyk are also welcomed to join the organisation comity force in order to facilitate the exchanges with NACE STG 34.

Topics for such a conference has been discussed during the meeting and participants suggested to emphasize the monitoring, life prediction, reliability items.

2.4 EUROCORR 2008

This annual working party meeting was held in Edinburgh during the Eurocorr 2008 conference "Managing corrosion for sustainability."

Two workshops have been organised :

- "Corrosion under insulation" on 8 September afternoon.
- "Naphtenic acid corrosion" on 11 September morning

The session dealing with refinery corrosion has been held on 10 September with the following sub sessions:

- "Refinery process corrosion,"
- "Ethanol biofuel corrosion,"
- "Refinery inspection monitoring"

Attendance of the working party sessions has increased. Between 40 and 60 persons attended the above session.

2.5 EUROCORR 2009

Eurocorr 2009 "Corrosion from the nanoscale to the plant" will take place in Nice, France from 6-10 September 2009. Its web site is:

<http://www.eurocorr.org/EUROCORR+2009-p-48254.html>

A session (n°13) related to corrosion in the refinery industry is planned.

Abstracts are welcomed and the deadline for submission is 30 January 2009.

More information is available in appendix 3.

3 Refinery corrosion failures

3.1 Corrosion of an ejector in a CCR

Alec Groysman (Oil Refineries Ltd) presented the failure of a Venturi scrubber in a FCC plant. The scrubber was designed to neutralize CO₂, HCl and Cl₂. After 9 months of service, a first Hastelloy B2 ejector failed due to a thinning of the wall thickness that has been attributed to cavitation. A new Hastelloy C276 scrubber replaced the Hastelloy B2 one, but it also corroded by pits and holes degradations. This time dew point type corrosion was the cause. Several remedies have been proposed (to maintain the temperature above 130°C, modification of the geometry, application of a inner ceramic coating, injection of inhibitors). More information is available in appendix 4.

3.2 Poor service of Monel type alloys as distillation tower internals in refineries

Another failure case has been presented by Miroslav Michvocik (MOL, Slovnaft) that concerns the deterioration of Monel 400 valve trays in an atmospheric

fractionation tower. This corrosion appeared during the last year of operation, nothing having been detected during the previous inspections. The corrosion treatment consisted only of the injection at the overhead of a filming inhibitor. The neutralizer injection has been stopped since 2004. The corrosion was due to the combined attack of complex forming species (ammonium and cyanide ions) that led to the selective leaching of copper from the nickel-copper matrix of alloy 400. A temporary replacement of damaged trays in type 410 stainless steel has been decided. The application of a neutralizer is still in discussion. Appendix 5 gives some more information on this failure.

4 Monitoring

CO₂ corrosion measurement by electrochemical methods

A high pressure electrochemical probe has been developed by A. Cafissi and professor S. Trasatti from Milan University in order to perform electrochemical noise (ECN) measurements in sour water environments. This probe can be easily installed into equipment without disturbing the system. After a presentation of the principle of ECN, results (that have been obtained under 170 bars at 60°C) and correlations with other electrochemical methods have been discussed as indicated in Appendix 6.

5 Discussion on "Optimal choice of materials, for seawater cooled refinery heat exchanger tubes"

A discussion has been initiated by György Isaak (MOL) on the optimal choice of materials for seawater cooled refinery heat exchanger tubes. A state-of-the-art on the conditions of failure – non failure has been presented in connection with the different types of damages: SCC by ammonia, erosion at high velocities with debris from the seawater. Experiences from the audience on the behaviour of duplex or high molybdenum containing stainless steels have been exchanged. The slides that were used to support the discussion are included in Appendix 7.

6 Stress relaxation cracking of stainless steels – advancement of the Cefracor survey

The relaxation cracking phenomenon had been previously discussed in WP15 meetings (especially during the 2007 spring meeting). Many WP15 participants supported the proposal to establish a standard test method and a guideline to prevent these failures, that could be published in the EFC guidelines series. An enquiry was initiated by Francois Dupoirion under the auspices of the Oil and Gas Committee of Cefracor (French corrosion association). This group continues the activities on this subject in order to propose a characterisation test and to have discussions with steel providers and with Codes authorities. A resume of the advancement of this task force is included in Appendix 8.

7 **Next Meetings**

2009 Spring WP15 Meeting

Borealis proposed to host the spring meeting at their polyolefin plant in Schwechat (the plant is next door to the OMV refinery, a few kilometres from the Vienna Airport, and close to the city of Vienna.) on **23 April 2009**.

The full agenda will be established later with the following topics: monitoring, inspection, failure cases, relaxation cracking of stainless steels, acid gas amine units treatment, cooling water treatment, other subjects...

2009 Autumn Full WP 15 Meeting:

This meeting will take place in Nice, France from 6-10 September 2009 during the Eurocorr 2009 conference.