

**Minutes of EFC WP 15
Corrosion in the Refinery Industry**

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1 WELCOME

Francois Ropital opened the meeting.

34 persons attended the meeting and briefly introduced themselves. The list of participants is 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.

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

2.2 Publications from WP15

The following publications from this working party are available:

- 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.efcweb.org/Publications/List+of+EFC+Publications.html>

Discussion on proposals for revision of these publications:

- EFC Guideline n°46: "Amine Unit Corrosion Survey"

EFC Guideline n°46 contains data that have been collected more than 10 years ago. An update seems necessary with the inclusion of decarbonation units. Initial work on this update is presented in section 5.

- EFC Guideline n°55: "Corrosion under insulation (CUI) guidelines".

An update is planned (see section 4 of this document)

Discussion on proposals for future publications:

- A best practice guideline to avoid and characterize high temperature stress relaxation cracking of austenitic materials. Advancement of the Cefracor group on the subject is noted in section 3).

2.3 Downloading Previous Eurocorr Conference Papers

Papers from the previous Eurocorr conferences (Eurocorr 2004, 2005, 2006, 2007, 2008, 2009, 2010) can be downloaded via the members pages of each of the national member societies of EFC. The list of EFC member societies is available on the web page

<http://www.efcweb.org/Who+we+are/Member+Societies.html>

Please contact your member society for more information on access to these papers.

2.4 Collaboration with NACE

Exchange of information between WP15 and the NACE groups dedicated to the same topics are encouraged. Rob Scanlan is the EFC WP15 representative for the NACE meetings during the annual NACE Conferences to inform on the WP15 activities. The minutes of the EFC WP15 and NACE STG 34 meetings are exchanged between Linda Goldberg and Francois Ropital.

2.5 EUROCORR 2011

This annual working party meeting was held in Stockholm during the Eurocorr 2011 conference "Developing solutions for the global challenge".

The session dealing with refinery corrosion has been held on 5 September and the joint Workshop with WP3 "High temperature corrosion in the refinery and process industries" took place on 6 September.

Attendance of the working party sessions was between 50 and 60 persons, a significant increase by comparison of the previous Eurocorr conference. This point reflects the high attendance of the 2011 congress : more than 900 participants.

2.6 EUROCORR 2012

Eurocorr 2012 "Safer world through better corrosion control" will take place in Istanbul, Turkey from 9-13 September 2012. Its web site is:

<http://www.eurocorr.org/EUROCORN+2012-p-48376.html>

A "Workshop on the occurrence and mechanisms of Environmentally Assisted Cracking" is organized with 5 other working parties (4,5,9,13 and 17). More information on this workshop is available with the following link:

http://www.efcweb.org/efcweb_media/Downloads/Eurocorr2012+workshop+on+EA+C.pdf

A refinery corrosion related session will also take place. As the topic of the conference is "Safety", proposals of papers on this topic are welcomed (RBI, monitoring,...).

Abstracts are welcomed and the deadline for submission is 10 February 2012.

2.7 EUROCORR 2013

Eurocorr 2013 "Corrosion control for a blue sky" will take place in Estoril, Portugal from 1-5 September 2013.

During this meeting, it has been proposed that a joint session could be organized with WP 19 (Corrosion of polymer materials) on the behaviour of plastic materials in refineries and petrochemical plants.

2.8 Courses

EFC wants to develop its proposal of courses in the different corrosion areas covered by its working parties.

During this WP meeting, a course on "stainless steel in the refinery industry" has been discussed. This course could include presentations for stainless steels makers and end users in refineries. This course could take place at a Eurocorr conference site, the day before the start of the conference. Francois Ropital will contact some of the WP15 members in order to prepare a proposal of course on this topic.

Another of course that has been proposed is coating with a special emphasis for their use in order to protect against corrosion of insulation.

On the EFC web site, a page given information on corrosion courses available in Europe has been opened:

<http://www.efcweb.org/Events/Courses-p-104190.html>

WP15 members should please send information on corrosion courses related to the refinery industry that they would like to be mentioned on the WP15 web page, to Francois Ropital.

2.9 WP15 Web page of failure cases

In order to facilitate exchange on corrosion failures and their remedies, it has been decided to open a dedicated web page within the WP15 page on the EFC website. All the participants agreed that this page would be fully opened without any restriction to consult it.

The failures cases that have collected during the recent years will be incorporated and new contributions (to be sent to Francois Ropital) are welcome.

The members will be informed when the web page will be opened on the EFC website.

2.10 Next 2012 WP15 spring meeting

The participants agreed to continue to have 2 working party meetings per year: one in spring and one during the annual Eurocorr conference.

Johan van Roij from Shell Global Solutions proposed to host the next spring meeting in Amsterdam during the last week of April 2012. After the meeting, Johan confirmed that a meeting room will be available on **Thursday 26 April 2012**. As it has been discussed further during the meeting, a dedicated meeting on the revision of the CUI guideline will take place at the same place, the day before the spring meeting on Wednesday 25 April 2012.

3 CORROSION UNDER INSULATION

3.1 Temati presentation on CUI

J. Sentjens (Temati) presented some considerations on Corrosion Under Insulation. Firstly some information on the vision of CUI for different companies is given. Then the importance of the expertise has been emphasised. Some proposals of solutions concluded the presentation.

More information is provided in Appendix 3.

3.2 TSA Implementation - Learnings from project deployment

John Houben from ExxonMobil gave a complete presentation on Thermal Spray Aluminium (TSA) coatings: the deposition techniques, the TSA applicators, and applications in worldwide projects. The slides of the presentation are provided in Appendix 4

3.3 Contacts with OGP and ISO

The oil and gas producers (OGP) Material Standards Subcommittee expressed an interest to have a presentation of EFC Publication No. 55 'Corrosion under insulation' and our experience around this issue, during their 1 September meeting in London. Stefan Winnik attended this meeting. In the framework of the establishment of an ISO standard on CUI, EFC WP15 will collaborate with OGP.

3.4 Update of the EFC n°55 guideline on CUI

A revision of the guideline appears useful, especially for old equipment that will not be covered by the future ISO standard.

An inquiry has been circulated to the EFC WP15 members in order to have feedback on the actual guideline and suggestions for improvement. Francois Ropital will resend the enquiry to WP15 members. and will also ensure that this document is also been transmitted to EFC WP13 (Oil & Gas Industry) and UK CUI Forum members. Stefan Winnik will send the enquiry to the NACE committee dedicated to CUI. This survey is collected by Stefan Winnik and Francois Ropital.

A specific meeting will take place on Wednesday 25 April 2012 in Amsterdam to discuss the revision (also see paragraph 2.10 of these minutes).

4 CORROSION MONITORING

C. Lavarde presented GE's Rightrax technology. The Rightrax corrosion monitoring system uses permanently installed ultrasonic sensors and for the high temperature device, permits remote monitoring of restricted or high-temperature areas (350-500°C). Mrs Laverde presented some applications for the oil & gas production industries, but this technology has also been applied in refineries and GE will give more information on them during a future WP15 meeting. More information is provided in Appendix 5.

5 CORROSION IN ACID GAS UNIT TREATMENT

As corrosion in acid gas treatment plants becomes an important issue, especially for future CO₂ capture and sequestration projects (CCS), an update of EFC n°46 guideline was launched. The first step is the preparation and the distribution by F. Ropital of an inquiry form on experiences of corrosion failures in amine plants. After validation by the task force, the inquiry form has been sent to EFC WP13 and 15 members. Francois Ropital will email the inquiry form again after this meeting.

As EFC will create a new task force on CCS, contact will be established with the chairman of this group.

The update document could contain 2 parts:

- A section one on the mechanisms of corrosion and on corrosion prevention methods in acid gas units. Brian Chambers proposed to send a list of the major papers and documents dealing with this topic.

- A second section that will be an update of the survey on field experiences in the different types of amine units.

More information is provided in Appendix 6.

6 HIGH TEMPERATURE HYDROGEN ATTACK

Johan Van Roij (Shell Global Solutions) presented a failure of a dissimilar metal weld (DMW) in a Texas tower heat exchanger of a platformer unit. The cause of failure was ascribed to local high temperature hydrogen attack (HTHA) of the fusion line between the dissimilar metal weld and the carbon steel base metal. It was noted that this area operates above the Nelson curve.

Crack formation due to HTHA is known to accelerate in areas of high stress. Due to its design and construction, the dissimilar metal weld closure joint had two types of stress concentrators at the fusion line (notch and weld defects). The slides presented are included in Appendix 7.

Recently, there have been several industry reports of HTHA cracking in carbon steel operating below the Nelson curve. At a May 2011 API meeting, presentations of HTHA failures in carbon steel were made to the API 941 subcommittee by three oil companies. The cases presented contained a number of common features:

- The metallurgy was carbon steel.
- The welds were not post-weld-heat-treated.
- The damage was characterized by micro-fissuring along the heat affected zones of the welds.

API sent an industrial alert (see Appendix 8).

7 LEAN DUPLEX STAINLESS STEELS FOR CRITICAL COOLING WATER HEAT EXCHANGERS

John Houben from ExxonMobil gave a presentation on the economic advantages to replace carbon steel by lean duplex stainless steels for critical cooling water heat exchangers. Carbon steel bundles remain a viable option for non-critical heat

exchangers but upgrades to lean duplex stainless steel can generate 15 to 30+% discount cash flow (DCF) for critical exchangers.
The slides presented are included in Appendix 9.

8 STRESS RELAXATION CRACKING OF STAINLESS STEELS

Hennie de Bruyn (Johnson Matthey) related feedback on a project with requirements for post weld heat treatment (PWHT) of a 304H vessel. The main points of the discussion have been:

- long-term effect of ageing heat treatment of creep properties of the material?
- can stress relaxation cracking be avoided in another way (avoid PWHT)?
- is PWHT sufficient?

More information is provided in Appendix 10.

Chretien Hermse presented the objectives of a new joint industrial project (JIP) that TNO intended to launch. More information on the first discussion meeting of this JIP (that took place on 22 September) is given in Appendix 11.

Many participants confirm that stress relaxation cracking is a hot topic and that a guideline and an approved test methodology are necessary.

9 TOPICS FROM THE AUDIENCE

The following topics have been discussed:

- High temperature vanadium salts corrosion
- Naphthenic acid corrosion
- Ethanol stress corrosion cracking: update of the API 939D document
- Transformation of NACE MR01-03 "Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments" as a ISO document. WP15 members are welcome to join group NACE-ISO committee.
- Experience with application of 904L in sour water strippers, cyanides
- Experience with built up of ammonia salts in overhead systems

10 NEXT MEETINGS

2012 Spring WP15 Meeting

This meeting will take place from 9h30 to 16h30 on **Thursday 26 April in Amsterdam** (Shell Global Solutions offices)

2012 Autumn Full WP 15 Meeting:

This meeting will take place Istanbul, Turkey during the Eurocorr 2012 conference from 9-13 September 2012.