

# **Minutes of EFC WP 15**

## **Corrosion in the Refinery Industry**

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Part 1-8

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## **1 Welcome**

The meeting was opened by Francois Ropital.

23 persons attended the meeting and shortly introduced themselves. Apologies were received from 14 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.

[http://www.efcweb.org/WP\\_on\\_Corrosion\\_in\\_the\\_Refinery\\_Industry-design.html](http://www.efcweb.org/WP_on_Corrosion_in_the_Refinery_Industry-design.html)

### **2.2 EFC WP15 organisation – appointment of a deputy chairman**

The EFC has recommended that the Working Party chairmen should appoint deputy chairmen to strengthen the WP activities and to act as substitutes when the chairmen could not attend meetings.

François Ropital fully supports the proposal for WP15 and Hennie de Bruyn was appointed as WP15 deputy chairman.

### **2.3 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 is in project in order to publish a joint NACE – EFC guideline on the topic. More information on this project is provided in paragraph 2.5.

- 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>

The following publication will be soon available:

- [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>

## **2.4 Collaboration with NACE**

Opportunities for collaboration between EFC and NACE are fully supported by the board of administrators of the two associations. Exchange of information between WP15 and the NACE groups dedicated to the same topics will be 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. Also during the annual WP15 meeting, some information will be given on NACE activities by NACE delegates.

## **2.5 Task force 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 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". The task group will be composed of representative of NACE TG361 (G. Hays), EFC WP1 (Prof. G. Schmidt) and EFC WP15 (V. Beucler). During a separate meeting held on 11 September in Freiburg, it has been decided that G. Hays will prepare a draft of the common document that will be then reviewed by the other members of the Task Force. A meeting of the task force is planned during the 2008 NACE conference in New Orleans.

## **2.6 EUROCORR 2007**

This annual working party meeting was held in Freiburg during the Eurocorr 2007 conference "Progress by corrosion control."

A joint workshop has been organised with WP3, High temperature corrosion, on "High Temperature Corrosion in the Chemical, Refinery and Petrochemical Industries" in collaboration with NACE STG 37 group

Two sessions dealing with refinery corrosion have been held:

- Session N "Refinery corrosion" on 12 September.
- Joint session T between WP1 ("Corrosion and scale inhibition") and WP15 "Inhibition in refineries" on 12 September.

## 2.7 EUROCORR 2008

Eurocorr 2008 "Managing corrosion for sustainability" will take place in Edinburgh, United Kingdom from 7-11 September 2008. Its web site is:

[http://www.eurocorr.org/EUROCORN\\_2008.html](http://www.eurocorr.org/EUROCORN_2008.html)

It is proposed that a joint workshop be organised with WP1, Corrosion and Scale Inhibition, on "Naphthenic Acid Corrosion". This workshop should be more focussed on investigation and testing methods.

An open workshop (without publication of papers) will also be organised on CUI case studies. Collaboration with NACE STG37 is expected.

A session related to corrosion in the refinery industry is also planned.

For both refinery sessions and workshops, **abstracts are welcomed and the deadline for submission is 30 January 2008.**

<http://www.eurocorr.org/EUROCORN+2008/Paper+Submission.html>

## 3 Relaxation cracking: information on the survey and further actions

During the EFC WP15 meeting on 26 April 2007 a very complete presentation on the relaxation cracking phenomenon was presented by Hans Van Wortel from TNO (Netherlands). This presentation led to an open discussion on the establishment of a standard test method and of a guideline to prevent these failures. Also in order to have an overview of the field experiences on stress relaxation cracking, an enquiry was initiated by Francois Dupoirion. This was done under auspices of the Oil and Gas Committee of Cefracor (French corrosion association). An enquiry form has been distributed to the WP15 members. At the date of the meeting, 7 failure cases have been transmitted. The enquiry form is again attached with this document in order to get other contributions. A complete review on the advancement of this topic will be done during the 2008 WP15 spring meeting.

## 4 Corrosion under insulation

### 4.1 EFC Guideline n°55

This document had been sent to the EFC Scientific Secretary and to the Publisher (Woodhead Publishing). It will be soon available as EFC guideline n°55:

<http://www.woodheadpublishing.com/en/book.aspx?bookID=1486>

Stefan Winnik, editor of the guideline, briefly presented the document. The presentation was followed by an open discussion on the application of TSA and on the different techniques of coating replacement.

## **4.2 External corrosion control program at the Humber Refinery**

Rob Scanlan presented the corrosion program that has been launched at the Humber Refinery to list and control vessels and areas of piping that are the more prone to CUI and external corrosion. The refurbishment work included 100% removal of the insulation and inspection. Rob's presentation is provided in Appendix 3.

## **5 Refinery Failure Cases Web page**

It is difficult to collect enough failure cases to prepare publication of a book. Therefore it has been decided to start with the creation of web site page in which WP15 members can incorporate their failure case data sheets. To identify the category of corrosion damage, the API 571 classification will be followed.

Francois Ropital presented the web area to collect and consult typical corrosion failure cases of the refinery industry in order to share experiences. Its address is:

<http://project.ifp.fr/cui-efc-wp15>

Members who would like to have access to this web area should send an email to Francois ([francois.ropital@ifp.fr](mailto:francois.ropital@ifp.fr)).

The guide "How to use the EFC WP15 Refinery Cases Web page" is enclosed in Appendix 4.

## **6 Refinery corrosion failures**

### **6.1 Cracking on the fireside of a gasoil heater**

Anni Visgard Nielsen (Statoil) presented several longitudinal cracks on the fire side of 304 stainless steel tubes in a gasoil heater of a hydrodesulfurizer unit. Some of the cracks are located near the heat affected zones. These penetrated the tube. An open discussion took place on the causes of these damages. Polythionic acid corrosion is suspected due to the detection of a sulphur layer on the outside faces of the tubes and the fact that the tube material is highly sensitised. More information is provided in Appendix 5.

### **6.2 Water wash injection point failure in a saturated gas plant**

Rob Scanlan presented the program of investigation that was decided after the April 2001 explosion and fire that occurred at the ConocoPhillips Humber Refinery. A 6" pipe carrying flammable gases failed just after an intermittent water wash location on the de-ethanizer overhead system. The corrosion morphology indicates an aqueous phase running along the bottom of the pipe, outside of the bend. The corrosion was caused by acidic sour water due to presence of hydrogen sulphide in the aqueous phase. The presentation is provided in Appendix 6.

### **6.3 Hydrogen embrittlement of austenitic stainless steel**

The failure of a methane pre-stripper column was reported by Hennie de Bruyn (Borealis Group). Hydrocarbon leaks have been detected due to penetrating cracks in the top ellipsoidal head. The material of construction is type 304L austenitic stainless steel. After removal of the top ellipsoidal head, an investigation was conducted which indicated that the vessel top head was not solution annealed after forming and that the high level of deformation resulted in the formation of strain-induced martensite. As hydrogen is present in the process gas, cracking was caused by hydrogen embrittlement. Some questions remain on the mechanism of hydrogen charging at very low temperature. More information can be found in Appendix 7.

### **7 Naphthenic acid corrosion**

Andrea Invernizzi presented some results on the research program on naphthenic acid corrosion that has been initiated at Milan University under the direction of Prof. Trasatti. One objective of this work is to study the influence of “simple” carboxylic acids and to underline the importance of molecular structure on the reactivity. Some of the results indicate that increasing the chain length and stearic effects causes a decrease in the corrosion rate. The complete presentation is incorporated in Appendix 8.

### **8 Next Meetings**

#### 2008 Spring WP15 Meeting

Nalco proposed to hosted the spring meeting in their **Leiden office** (located near Den Haag and Amsterdam and easy to reach from Schiphol) **on Tuesday 15 April 2008**.

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...

#### 2008 Autumn Full WP 15 Meeting:

This meeting will take place in Edinburgh, United Kingdom from 7-11 September 2008 during the Eurocorr 2008 conference.