Minutes of EFC WP 15

Corrosion in the Refinery Industry

Paris La Défense (France)

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Prepared by

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Acknowledgement

The EFC WP 15 Refinery Corrosion Group would like to express thanks to Total for hosting this meeting in Paris La Défense with special thanks to Martin Richez for the organisation of the meeting.

1 Welcome

The meeting was opened by Martin Richez from Total Marketing Raffinage. Total worldwide refining capacity was approximately 2.7 million barrels of oil per day and selling approximately 3.8 million barrels of petroleum products per day in 2006. The downstream business employs 34, 467 people. Total Marketing Raffinage manages 12 refineries in Europe (6 in France, 2 in UK, 1 in Italy, Belgium, Netherlands and Germany), 6 in Africa, 1 in USA and 1 in Venezuela. Total has also shares in refineries in Spain, South Africa and China and investments are going in Saudi Arabia for a new refinery and in Alberta for an upgrade of Althabasca refinery. Total downstream R&D activities are located in 3 European Research Centres in Feluy, Solaize and Gonfreville.

23 persons attended the meeting and shortly introduced themselves. Apologies were received from 24 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 were presented by Francois Ropital. This information can also be found on the EFC web-site (http://www.efcweb.org/WP_on_Corrosion_in_the_Refinery_Industry.html) where the minutes of previous WP15 meetings minutes can be consulted and downloaded. More information is enclosed in Appendix 2.

2.2 Publications

The following publications from WP15 group are available:

- EFC Guideline no. 40: Prevention of Corrosion by Cooling Waters
  http://www.woodheadpublishing.com/en/book.aspx?bookID=1193
- EFC Guideline n° 42: A Collection of Selected Papers
  http://www.woodheadpublishing.com/en/book.aspx?bookID=1295
- EFC Guideline °46: Amine Unit Survey
  http://www.woodheadpublishing.com/en/book.aspx?bookID=1299

Publication in preparation:

- Corrosion under insulation.

This new guideline advancement had been presented during the meeting (see Paragraph 3.1 .

The project of a refinery failure cases atlas has been then discussed. As it appears difficult to get the necessary amount of contributions in order to prepare a book, it has been decided to start with the creation of web site page in which the members of the group could incorporate their failure case data sheets. To identify the category of corrosion damage, the API 571 classification will be followed. A detailed presentation of this project will be performed during next WP15 meeting in Freiburg.

2.3 Collaboration with NACE

Corrosion in cooling water treatment:
A task force group between NACE TG 361 group and EFC WP 1 (Inhibition and Scaling) and WP 15 has been launched to cooperate on the publication of updated documents in the field of corrosion in cooling water treatment systems. A meeting took place in March during the NACE 2007 Conference.

Joint session with NACE during Eurocorr 2008 (in Edinburgh) :
Francois Ropital has contacted Mr De Yuan Fan, STG 34 chairman, in order to propose a joint session on "detailed case studies on RBI".

2.4 Collaboration with other EFC Working Parties

During Eurocorr 2008 (in Edinburgh), a joint workshop on "naphtenic acid corrosion" is proposed by Working Party 1 "Inhibition and Scaling".

2.5 EUROCORR 2007

Eurocorr 2007 "Progress by corrosion control" will take place in Freiburg, Germany from 9-13 September 2006.

Its web site is http://www.eurocorr.org/EUROCORR+2007.html

A joint workshop will be organised with working party 3 ("High temperature corrosion") on "High Temperature Corrosion in the Chemical, Refinery and Petrochemical Industries" in collaboration with NACE STG 37 group.

You will find the draft program of these sessions in Appendix 2.
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3 Corrosion under insulation

3.1 Information on the achievement of the EFC CUI guideline

A presentation of the document has been done by Rob Scanlan and Stefan Winnick during the 11 March meeting of the NACE TG 325 group in the frame of the NACE 2007 Conference. The NACE TG 325 meeting was dedicated to the update the NACE RP0198-04 document. Some additional comments on the CUI EFC document from TG 325 members have been provided. For the updated RP0198-04 documents some minor changes will be performed in reference with the EFC document.
The finalizes CUI EFC document is planned to be issued by late 2007.

3.2 CUI, PCO T/A 2007 feedback, Inspection prioritization program for the future A. Surbled – Couronnaise de Raffinage

Antoine Surbled from Shell Couronnaise de Raffinage (France) gave some feedback on implanting the RBI CUI program in the Petit Couronne refinery. The main steps of the CUI assessment and inspection strategies had been presented and discussed. One of the remedies is the application of Thermal Spray Aluminium (TSA) for which more data on their long term behaviour appear to be necessary. Another important point of discussion was the best ways of coating removals during delaging. More information is enclosed in Appendix 3.

3.3 Thermal High Temp Technology on new insulative and personal protective coating - M. MeLampy -

The High-Temps Coatings Technology Company commercialise a Hi-Temp PPC 703 coating that allows personnel protection up to 177°C. The coating is a water base one with 77% volume solids: it can be directly applied to hot (up to 260°C) steel plates. To get a 177°C thermal protection a 3 mm thick coating is required (4 layers). Discussion on the type of surface preparation (S2 blasting) and on the application of NDT control techniques concluded the presentation. More information is provided in Appendix 4.

4 Relaxation Cracking of stainless steels

4.1 Experiences with relaxation cracking of 304H, 347 and alloy 800H in a ethylene cracker furnace - H. de Bruyn – Borealis Group

Hennie de Bruyn from the Borealis Group (Norway) reported some investigation on failures due to relaxation cracking. The examples that were presented, concerned 304H (for a de coke air line), 347 H (for PI connections) stainless steels and alloy 800H (for PI connections) failures in millisecond steam cracking furnaces. The

identification of relaxing type cracking requires special care in order to be not confused with thermal fatigue. Proper preparation and etching conditions are essential in order to clearly identify the relaxation cracking phenomena. More information is provided in Appendix 5.

4.2 Control of Relaxation Cracking in austenitic high temperature components H. Van Wortel - TNO

A very complete presentation on the relaxation cracking phenomena was given by Hans Van Wortel from TNO (Netherlands). More than 50 failure cases due to relaxation cracking have been listed by M. Van Wortel, mainly for 800H alloy and 347H stainless steel. The failure analysis outcome was that relaxation cracking susceptibility could not be assessed or predicted by standard mechanical tests. The relaxation failures occur within 0.5 - 2 years service, with cracks always on grain boundaries, often with a metallic filament inside the crack. The failures are located in welded and cold formed areas (Vickers hardness > 200 HV5) and occur for metal temperature between 500 and 750°C. In order to determine the main factors that affect relaxation cracking of austenitic materials (mainly alloys 800H and 617) and how to control the phenomena, TNO managed a JIP with 35 partners. This JIP led to recommended practice for the identification and prevention of relaxation cracking and a equipment degradation document (EDD). This presentation led to an opened discussion on the establishment of a standard test method and of a guideline to prevent these failures. More information is enclosed in Appendix 6.

4.3 Joint EFC-Cefracor stress relaxation cracking enquiry

In order to have an overview of the field experiences on stress relaxation cracking an enquiry has been launched by the Oil and Gas Comity of Cefracor (French corrosion association). The enquiry form is included in this document. Replies before the 2 September 2007 are welcomed : a summary of this enquiry will be done during the next 13 September WP15 meeting.

5 Prevention of atmospheric corrosion

5.1 Prevention of atmospheric corrosion on carbon steel by means of Sofeisation M. Lanfant - SOFRESID

Mr Lanfant form SOFRESID (France) presented the performance of an hydrophobic paint that can be directly applied on rusted steel surfaces in order to prevent atmospheric corrosion in a temperature range -55°C +180°C. This product had been successfully applied to protect pipelines during the last 35 years. More information is given in Appendix 7.

6 Caustic SCC of carbon steel in FCC unit

6.1 Information on the Nace TG347 Survey

Carbonate stress corrosion cracking in refinery process streams has been reported since the early 1980s. Most of the failure reports have been associated with the FCCU main fractionator overhead systems and FCCU gas plants. The number of reported incidents increases since 2000. This increase may be attributed to the fundamental operating change to the production of low sulfur products directly from the FCCU. NACE TG 347 has prepared a technical committee report to provide information on Alkaline Carbonate Stress Corrosion Cracking (ACSCC). This work is intended to provide some basic information on what ACSCC is, where it has been found, conditions thought to promote the cracking, operating conditions and process parameters that may have an impact on it, an overview of analytical methods, inspection tools, and mitigation techniques that have been used to manage the problem. Francois Ropital presented the main issues of this survey. A copy of the slides that were presented is enclosed in Appendix 8.

6.2 Inhibition of carbonate SCC in FCC's - C. Claesen – Nalco Energy Services

Chris Claesen (Nalco Energy Services) detailed some laboratory and field results on the inhibition of Alkaline Carbonate Stress Corrosion Cracking. An example of an unit in which a change due to feed hydrotreating occurs, was presented in correlation with the risk assessment according API 581. The main points of discussion were about accurate sampling and analytical technical methods and on the need of proper PWHT. The use of an inhibitor can help but is not recommended as a sole prevention strategy. More information on this presentation is enclosed in Appendix 9.

7 Monitoring

7.1 State of the art with case studies on online corrosion monitoring Ayman Mehdawe - Honeywell

Mr Ayman Mehdawe presented Honeywell offers on corrosion measurement technology (SmartCET®), on corrosion modelling tools (softwares) and on expert corrosion services (consulting, laboratory testing, failure analysis). The application of these offers was illustrated by two cases studies : the first one concerned condensers of cooling towers and the second one an amine unit during changes in operational practices. More information is given in Appendix 10.

8 Next Meeting

*The next autumn meeting will take place in **Freiburg (Germany)** during the Eurocorr 2007 conference, on **Thursday 13 September from 9 – 16h** .*
The finalised agenda is in preparation and it will be send to WP15 members by 15 July.