Appendix 1

List of participants

Participants EFC WP15 meeting 15th September 2010 Moscow (Russia)

Albertsen	Jorun Zahl	Statoil ASA	NORWAY
Bonilla	Fernando	V&M France	FRANCE
Claesen	Chris	Nalco	BELGIUM
de Bruyn	Hennie	Johnson Matthey Catalysts	UK
de Marco	Marco	Istituto Italiano della Saldatura	ITALY
Goldberg	Linda	NACE International	US
Groysman	Alec	Oil Refineries Ltd	ISRAEL
Loukachenko	Natalia	Arcelor Mittal	FRANCE
Medvedeva	Marina	Gubkin State Oil and Gas University	RUSSIA
Rajek	Joachim	OMV	AUSTRIA
Ropital	François	IFP Energies nouvelles	FRANCE
Roumeau	Xavier	Total	FRANCE
Sielski	Grzegorz	Sandvik Poland	POLAND
Silinskaya	Yana	LSC Angarsk Petrochemical Co	RUSSIA
Tomin	Viktor	LSC Angarsk Petrochemical Co	RUSSIA
Torkkeli	Janne	Neste Jacobs Oy	FINLAND
van Roij	Johan	Shell Global Solutions International B.V.	NETHERLANDS
Vanacore	Mario	Nalco	ITALY

Appendix 2

EFC WP15 Activities

Welcome to the EFC Working Party Meeting

"Corrosion in Refinery" WP15

Moscow 15 September 2010

EUROPÄISCHE FÖDERATION KORROSION
EUROPEAN FEDERATION OF CORROSION
FEDERATION EUROPEENNE DE LA CORROSION

AGENDA EFC Working Party 15
Corrosion Refinery Industry Meeting

15h00- 15h45	WP15 Activities (F. Ropital) Eurocorr 2011 (Stockholm) sessions and workshops, publications, collaborations with NACE collaboration with Japan ENAA on CUI other points
15h45-16h15	Coffee break
16h15-16h45	Stress Relaxation Cracking
16h45-18h00	Corrosion failures and other topics from the audience

Presentation of the activities of WP15

European Federation of Corrosion (EFC)

- Federation of 31 National Associations
- 18 Working Parties (WP) + 1 Task Force
- Annual Corrosion congress « Eurocorr »
- Thematic workshops and symposiums
- Working Party meetings (for WP15 twice a year)
- Publications
- EFC - NACE agreement (20% discount on books price)
- for more information http://www.efcweb.org

EFC Working Party 15 « Corrosion in Refinery » Activities

Who is an EFC member

To be an EFC member you (individually or your company, university) has to be member of one of 30 national EFC "member societies". Your company or university can now also an affiliate membre.

For example:
in Norway: Norsk Korrojonstekniske Forening
in France: Cefracor or Federation Française de Chimie
in Germany: Dechema or GfKORR
in UK: Institute of Corrosion or IOM
in Israel: CAMPI or Israel Corrosion Forum
in Poland: Polish Corrosion Society
.....
You will find all these information on www.efcweb.org or in the EFC Newsletter

Benefits to be an EFC member:
- 20% discount on EFC Publications and NACE Publications
-reduction at the Eurocorr conference
-access the new EFC web restricted pages (papers of the previous Eurocorr Conference) via your national corrosion society web pages

EFC Working Parties

http://www.efcweb.org

- WP 1: Corrosion Inhibition
- WP 3: High Temperature
- WP 4: Nuclear Corrosion
- WP 5: Environmental Sensitive Fracture
- WP 6: Surface Science and Mechanisms of corrosion and protection
- WP 7: Education
- WP 8: Testing
- WP 9: Marine Corrosion
- WP 10: Microbial Corrosion
- WP 11: Corrosion of reinforcement in concrete
- WP 12: Computer based information systems
- WP 13: Corrosion in oil and gas production
- WP 14: Coatings
- WP 15: Corrosion in the refinery industry
  (created in sept. 96 with John Harston as first chairman)
- WP 16: Cathodic protection
- WP 17: Automotive
- WP 18: Tribocorrosion
- WP 19: Corrosion of polymer materials
- WP 20: Corrosion by drinking waters
- WP 21: Corrosion of heritage artefacts

EFC Working Party 15 « Corrosion in Refinery » Activities

http://www.efcweb.org/Working+Parties-p-104085/WP%2B15-p-104111.html

Chairman: Francois Ropital email: francois.ropital@ifpenergiesnouvelles.fr
Deputy Chairman: Hennie de Bruyn email: Hennie.DeBruyn@matthey.com

The following are the main areas being pursued by the Working Party:

Information Exchange
Sharing of refinery materials /corrosion experiences by operating company representatives.

Forum for Technology
Sharing materials/ corrosion/ protection/ monitoring information by providers

Eurocorr Conferences

WP Meetings
One WP 15 working party meeting in Spring,
One meeting at Eurocorr in September in conjunction with the conference,

Publications - Guidelines

Publications from WP15

• EFC Guideline n°40 « Prevention of corrosion by cooling waters » available from http://www.woodheadpublishing.com/en/book.aspx?bookID=1193

Update in relation with Nace document 11106 "Monitoring and adjustment of cooling water treatment operating parameters" Task Group 152 on cooling water systems

• EFC Guideline n° 46 on corrosion in amine units
http://www.woodheadpublishing.com/en/book.aspx?bookID=1299

•EFC Guideline n° 42 Collection of selected papers
http://www.woodheadpublishing.com/en/book.aspx?bookID=1295

•EFC Guideline n° 55 Corrosion Under Insulation
http://www.woodheadpublishing.com/en/book.aspx?bookID=1486

•Future publications : suggestions ?

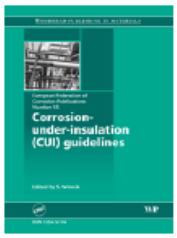
- best practice guideline to avoid and characterize stress relaxation cracking ?

WOODHEAD PUBLISHING LIMITED

Woodhead Publishing Limited, Abington Hall, Abington, Cambridge, CB1 6AH, England
Tel: +44 (0)1223 891 358 Fax: +44 (0)1223 893 694 Email: wp@woodheadpublishing.com

Corrosion under insulation (CUI) guidelines: (EFC 55)

Edited by S Winnik, ExxonMobil, UK



- guidelines cover inspection methodology for CUI, inspection techniques, including non-destructive evaluation methods and recommended best practice
- case studies are included illustrating key points in the book

Corrosion under insulation (CUI) refers to the external corrosion of piping and vessels that occurs underneath externally clad/jacketed insulation as a result of the penetration of water. By its very nature CUI tends to remain undetected until the insulation and cladding/jacketing is removed to allow inspection or when leaks occur. CUI is a common problem shared by the refining, petrochemical, power, industrial, onshore and offshore industries.

The European Federation of Corrosion (EFC) Working Parties WP13 and WP15 have worked to provide guidelines on managing CUI together with a number of major European refining, petrochemical and offshore companies including BP, Chevron-Texaco, Conoco-Phillips, ENI, Exxon-Mobil, IFP, MOL, Scanraff, Statoil, Shell, Total and Borealis. The guidelines within this document are intended for use on all plants and installations that contain insulated vessels, piping and equipment. The guidelines cover a risk-based inspection methodology for CUI, inspection techniques (including non-destructive evaluation methods) and recommended best practice for mitigating CUI, including design of plant and equipment, coatings and the use of thermal spray techniques, types of insulation, cladding/jacketing materials and protection guards. The guidelines also include case studies.

ISBN 1 84569 423 6
[ISBN-13: 978 1 84569 423 4]
March 2008
176 pages 234 x 156mm hardback
£115.00 / US$230.00 / €170.00

Add to basket

Usually dispatched within 24 hours

Publications from WP15

EFC Guideline n° 55 Corrosion Under Insulation
Revision in collaboration with ENAA ? and others ?

"CUI problems in chemical process industries, Japan, have been considered to be very severe, in terms of "Safety and Security" or "HSE". Based on these circumstances, the CUI committee was organized in 2007 by ENAA(Engineering Advancement Association of Japan), a subsidiary organization under the Ministry of Economy, Trade and Industry. **The main purpose of the CUI committee would complete "the CUI Guideline" for preventing CUI, in terms of corrosion management in addition to NDT.**

This year, 2010, is the 4th year of this project, and we will make the 1st draft of CUI guideline. So, if possible, we will discuss this matter with EFC.
So, we would like to have the official meeting with EFCand ENAA on CUI.
1. ENAA would like to have the technical meeting on CUI with the key members o f EFC, who have been involved to establish the CUI guideline of EFC, in coming October or November, in Europe.
2. We will deeply explain Japanese CUI problems including the activity of the ENAA's CUI committee and CUI in Asian countries
3. We also discuss CUI guideline, in terms of NDT, preventive management(including risk based management to prevent CUI), case studies on actual applications of EFC's CUI Guideline
4. Others on CUI and corrosion failures in Japanese CPI

EFC Working Party 15 plan work 2010-2012

. Exchanges with NACE

•Web seminar with Nace

"NACE TEG 205X information exchange -corrosion in refineries " has been recorded during San Antonio Corrosion Conference is available on the Web and an email has been sent last week to EFC WP15 members.

. Exchanges of on NACE STG 34 and EFC WP15 activities
Rob Scanlan is the EFC WP15 respresentative

web pages of the minutes of STG 34 sub groups (TEG)

http://web.nace.org/Departments/Technical/Directory/Committee.aspx?id=ecdc32a6-5fef-db11-9194-0017a4466950

EFC Working Party 15 plan work 2010-2012

. Sessions with other EFC WP at Eurocorr
(2011 in Stockholm, 2012 in Istanbul, 2013 in Estoril):

in 2011 with WP3 on high temperature corrosion ?

- Typical corrosion failure cases atlas : stand by
- Publications
- Education – qualification – certification
- Next WP15 spring meeting ? where ? when ?

EFC Working Party 15: Future objectives of the group

How to manage our working party meetings / Eurocorr sessions

· Eurocorr Sessions
✓Implements of Eurocorr sessions or workshops with other WP and NACE
(a workshop can be on a topic without formal presentation)

✓Implication of young corrosion students, PhD
at Eurocorr session with a dedicated poster session

. Working Party Meetings
✓Future topics of task forces
✓Facilitating student trainings outside their countries in our companies
✓Presentation of UE funding projects in our area (if they are)
✓Collaboration on Standard

Increase the collaboration with NACE
exchange of information on our activities - joint Eurocorr sessions

Information :
Future conferences related to refinery corrosion

· 19-24 September 2010
NACE Corrosion Technology Week 2010,Orlando FL Website: www.nace.org

•29-30 Septeber 2010
ESOPE Paris (F) Website: http://www.chaudronnerie-expo.com/?lang=en

•13-15 October 2010

Duplex stainless steels conference and exhibition - Beaune (F)
http://www.stainless-steel-world.net/duplex2010/

•13-17 March 2011
CORROSION 2011/NACEHouston, Texas Website: www.nace.org

•5-8 September 2011
EUROCORR 2011 Stockholm, Sweden Website: www.efcweb.org/Events

20-25 May 2012
High Temperature Corrosion and Protection of Materials - Les Embiez (F)

Appendix 3

Content of the EFC guideline 46

"Amine units corrosion survey"

Contents

Appendix 4

Stress Relaxation Cracking of

Stainless steels

CEFRACOR
French corrosion Society

Corrosion in Oil and Gas Industries
High temperature working group

Members :

CETIM , EPA, Haynes Intl , IFP , Industeel , Heurtey Petrochem, Technip, Total

Oil and gas High temperature group GT9 :

Specific CEFRACOR Comittee

Main goals :

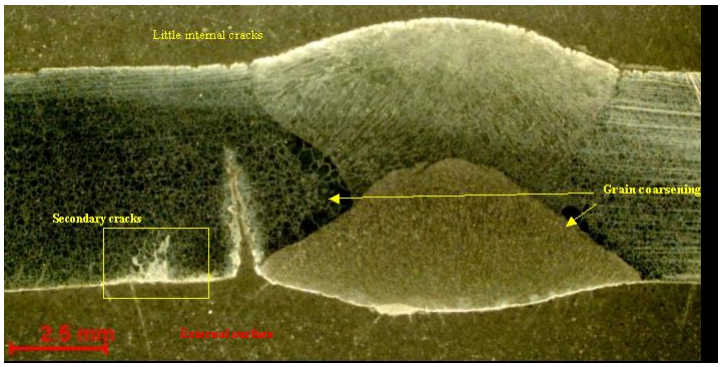
- Return of experience exchanges
- « Forum « between users (Petrochemical, Refinery , Chemical industries) , Research center , producers , fabricatior, engineering .
- Works on specific topics : Stress relaxation cracking

2

Stress Relaxation Cracking :

Cracking phenomenon of the austenitic grades working at high temperatures 450 à 800°C and particularly in case of high stress and strain.

Location : primarily in heat affected zone but not only !



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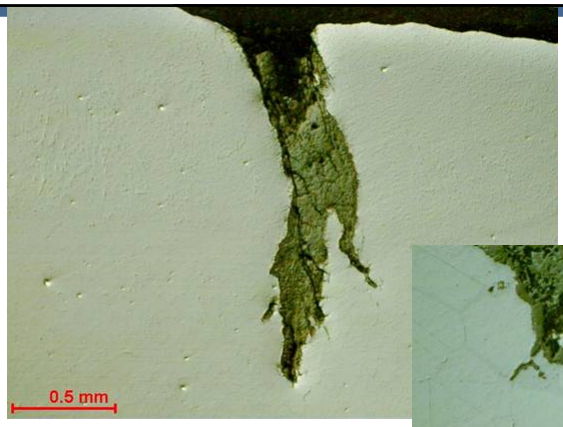
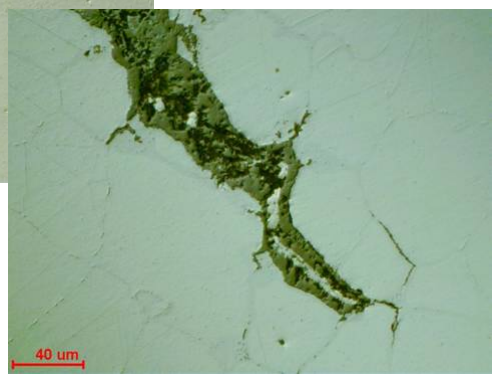


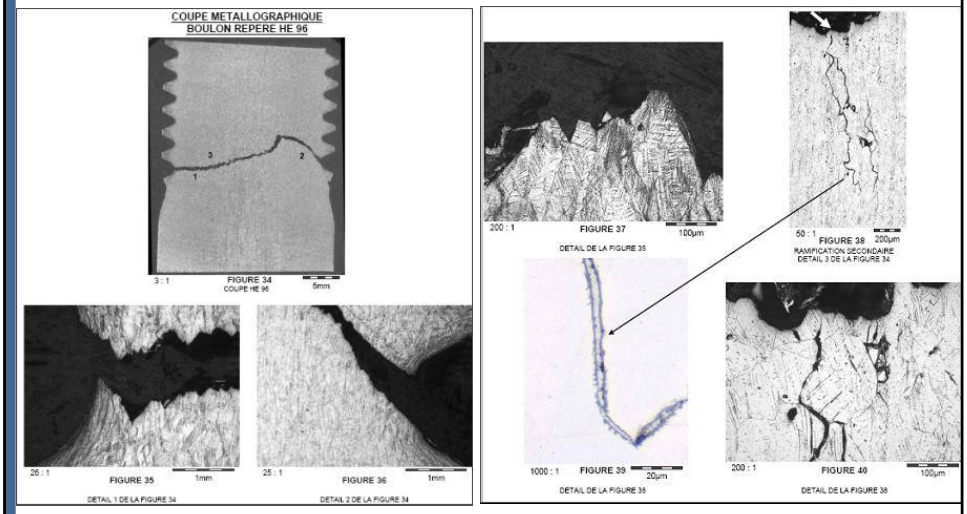
Intergranular



nickel filament

4

Location : primarily in heat affected zone but not only !
Cold work 304 Cu – 550°C



Grain size 2-3 , hardness 250-290Hv –Intergranular rupture – Metalic filament

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Stress Relaxation Cracking 450-850°C

- **Thicker walls (>1") more susceptible for cracking during fabrication; all thicknesses can crack in-service**
- **Location – primarily HAZ and highly stressed zone (stresses , cold worked)**
- **High sensitivity to grain size particularly coarser than 3**
- **Sensitivity to (?):**
  - Heat input and residual stresses
  - Cold work
  - Thermal expansion differences between filler material and base material
  - Filler metal contraction level

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Stress Relaxation Cracking :

- **Caracterisation :**
  - Short term and high stresses:cracking can occur during heat treatment... => high heat rate in the sensitive zone and low cooling rate
  - Long term : cracks observed in the first 18 months
  - Expertise Intergranular:crack in the highly stressed zones, Ni filament

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Stress Relaxation Cracking :

- **Caracterisation :**
  - Expertise Intergranular:crack in the highly stressed zones, Ni filament

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JIP in preparation

A- Correlation determination from data banks: correlation from "plant results" and main parameters in order to affect severity factors

B-Experimental validations of the correlations :
From the correlations , run an experimental to validate 2 sensitive steels (800H and 347H) to study:
- Variations of the composition and microstructure.
- Variation of residual stresses ,
- Variation of welding parameters.
- Hardening to simulate hot forming
- Validation of the effect of thermal treatments

C-Modelization :
From the previous steps
establishment of a risk evaluation matrix
definition of a methodology to evaluate the sensitivity for new steel grade or a new elaboration process.

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JIP in preparation

Alloy manufactures: Industeel, Outokumpu , Special metals , Haynes , VDM Krupp , Sumitomo, Sandvik , DMV , Metrode Boehler Thyssen …

- Boiler makers: Verolmes , ATC , ACM …

- Engineering : Technip , Fluor , Shaw (Badger) , Heurtey , Hude , Areva…

- End users : Total , BASF , Bayer , Dow Chemicals , Exxon Mobil, Shell , EDF, RWE ,

- Notified bodies on RBI : DNV , Bureau Veritas , TUV , AFIAP ,

- Independent research centers: TNO , BIL (Institut de soudure Belge) , EWI , DECHEMA …

For further information contact: francois.dupoiron@total.com

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