

Minutes of meeting
WP13 Corrosion in oil and gas production

Edinburgh, 10th September 2008

Joint WP 19 and WP 13 meeting

R. Morach, chairman of WP 19 opened the meeting with a brief description of the WP activities.

G. Schmitt gave a presentation (Presentation in appendix A) about the status of the development of ISO 23936 that will consist of the following parts:

Part 1: Thermoplastics

Part 2: Elastomers

Part 3. Thermosets

Part 4: Fibre reinforced composites

Part 5: Other non-metallic materials

The scope of the work is to describe general principles and to give requirements and recommendations for the selection, qualification and guidance for quality assurance of non-metallic materials for service in equipment used in oil and gas production environments.

Status:

ISO 23936-1: FDIS submitted for voting to ISO-Secretariat on 15.08.2008.

ISO 23936-2: FDIS End of 2009 (planning)

The possibility of organising a joint WP 13 & 19 at Eurocorr 2009 was discussed. It was agreed that such a session focusing on design, NDT, operation and inspection of structures made of polymeric materials for use in oil and gas production should be planned.

Post meeting note: The organisation of this joint session is underway, with at least 3 papers forecasted: one on polymeric materials (Arkema), one on flexible pipes pressure sheaths (Technip), and one on use of non metallics in the oil & gas industry (Total).

Introduction to WP13 business meeting

Thierry Chevrot from TOTAL in Paris will take over as WP13 chairman after Eurocorr 2008. Jean Kittel from IFP will at the same time start as WP13 vice chairman.

New ISO standard for materials selection in the oil and gas upstream industry

S. Olsen presented the ongoing work to develop an ISO standard 21457 on "Materials selection and corrosion control for oil and gas production systems" (Presentation in Appendix B).

The objective with the standard is to get better quality and more cost effective solutions.

- Less manhours used in projects, both by oil company and engineering contractors.
- Less need for company and project specifications.

By implementing the materials requirements currently used by the industry in the standards, the need for material requirements in company and projects specifications would be reduced. This would create a more predictable situation for suppliers, manufacturers and contractors.

This ISO standard applies to hydrocarbon production, injection, processing and utility systems. This includes all equipment from and including the well head, to and including pipeline for stabilized products. Downhole components are excluded.

In the standard, guidance is given for:

- corrosion evaluations;
- materials selection for specific applications and/or systems;
- performance limitations for specific materials;
- corrosion control;
- qualification of materials and manufacturers.

The committee draft is now out for hearing and voting. The plan is to publish the standard in mid 2010.

C-steel in H₂S service

Chairman: Liane Smith

Liane Smith presented the main changes in EFC 16 3rd edition which will soon be published. (Table with comments in Appendix C and table with changes in Appendix D).

The EFC 16 is frequently referenced in the ISO 15156, and it is important that these documents are in line. After discussions in both groups, it was agreed to take out the sentence about external CP and effect on the cap hardness for C-steel welds to accommodate the balloted change in ISO15156-2. The change in acceptance criteria for HIC testing is another change to bring the two documents in line.

The following note to be put in the new document summarises the main changes from 2nd to 3rd edition of EFC 16: “Since the first publication, experience has highlighted improvements which could be made to the guidance given in this document, particularly for test methods. Specifically it was found that the test solution was difficult to maintain within the pH range over the full duration. Frequent adjustments to the pH resulted in the risk of air entering the test chamber. Other aspects which lacked clarity concerned the evaluation of HIC and C-ring and 4-pb SSC test samples. Improvements to the text on these matters, plus minor editorial improvements, are incorporated in this third edition.”

There were no comments or questions.

CRA in H₂S service

Chairman: Chris Fowler

Chris Fowler presented the changes to EFC 17. Section A 7.7 “Strain gauging” has been changed, and the formula to calculate the equivalent strain has been corrected. A new edition of EFC 17 will be printed with these changes.

Roger Francis presented results from testing of super duplex (Z100) to determine the threshold conditions with respect to HE from cathodic protection for some typical products used subsea. (Presentation in Appendix E). Smooth tensile specimens were exposed to seawater and CP under constant loading for 720 hours. There were no sign of cracks for

specimens loaded up to 95% of actual yield stress or up to 1.5% strain. The results show that design criteria based on previous failures (Foinaven) are too conservative.

Chris Fowler gave a presentation discussing the validity of four point bent testing. (Presentation in Appendix F). In order to control the local stresses, the specimen must be homogeneous in geometry and properties and the stress level shall be in the elastic region for carbon steel. Stressing of welded specimens according to ISO 15156 and EFC 16 and 17 will create conditions far from this. With the weld root intact, a curved specimen and mismatch will prevent control of stresses. Other aspects that complicate the issue and influence the outcome of the test are:

- Temperature de-rating
- Stress-strain curve normally obtained from tensile specimens
- Required stress level (90% and 100% of AYS for C-steel and CRAs, respectively)
- Acceptance criteria are not well defined

Stuart Bond gave a short presentation of FEA of a four point bend specimen in stainless steel at elevated temperature, (Presentation in Appendix G). The results illustrate that the actual stress can be far from the target value after stress relaxation.

It was a general agreement that work was needed to define a better testing procedure for four point bend testing of steels and CRAs. A group of the following people was formed:

- Stuart Bond (Chairman)
- Chris Fowler
- Stein Olsen
- Alan Turnbull
- Christoph Bosch
- Masakatsu Ueda
- Shuji Hashizume
- Brian Chambers
- Marc Wilms

It should be discussed if this work could be undertaken jointly by EFC and NACE.

Stuart Bond presented data from H₂S cracking testing of AISI 316 undertaken in a JIP at TWI. (Presentation in Appendix H). A ballot will be sent to MP in ISO 15156 with changes of the temperature and H₂S limits for 1000ppm chloride at pH 3.5 and for 50000ppm chloride at pH 4.5.

Ed Wade who chaired the work in the early nineties to develop the EFC publication no 17, informed that the annex dealing with water analyses is outdated and should be updated. To do this will require quite an effort, and a group should be set up. A new edition of EFC 17 will be printed soon, and a major revision of the annex on water chemistry will take too much time to be included in the next edition. This issue will therefore be postponed to the next meeting in Nice.

CO₂ corrosion

Chairman: Rolf Nyborg

Rolf Nyborg gave an update regarding the document on CO₂ prediction. It was decided in the 2007 meeting that this document will not be published by EFC. Rolf Nyborg informed

that the group will finish the work and that the report will be published by IFE.
(Presentation in Appendix I).

Materials compatibility and corrosion testing of workover and completion fluids

S. Nodland presented a document prepared by a group of operators that describes a test protocol for corrosion testing of workover and completion fluids. The document aims to standardise the requirements for testing of such fluids to provide a common basis for comparison and risk assessment of the fluids' corrosivity and stability.

(Presentation in Appendix J)

As this is a document not developed by the WP, it was discussed if EFC should publish such a document. Based on the following discussion, most people felt that EFC could published information if it could be of benefit for the members.

It was proposed that a group was formed to discuss the proposed document. During the next WP meeting, the document and any comments will be discussed.

The following people volunteered for this group:

- Staale Nodland (chairman)
- John Martin
- Titiana Cheldi
- Ed Wade
- Mohen Achour
- Thierry Cassagne
- Siv Howard

The Use of Inhibitors in Oil and Gas Production

Chairman: Jim Palmer

Jim Palmer informed that G. Winning will take over the position as chairman for this working group.

Mohsen Achour gave a presentation on "Corrosion inhibitor transport in oil export pipelines – food for thoughts". He described a scenario with low BS&W, CO₂ and H₂S present, scaling water, presence of emulsion, potential wax formation, maintenance cleaning, continuous and batch inhibition, biocide treatment, intermittent slugging, occasional flow backs. The following issues were listed as important to achieve good corrosion control:

- Good understanding of the field operating conditions is vital (hydrodynamics in particular)
- Laboratory testing to assess various issues can help
- Well targeted corrosion monitoring is a must
- Inspection surveys are mandatory
- A good practice to ensure good transport of CI:
 - o keep the pipe clean through aggressive maintenance pigging program
 - o control scale formation
 - o control bacteria growth
 - o link the monitoring/inspection data with the corrosion control program

In the following discussion there were some remarks regarding testing in the lab versus real field conditions. It was also commented that scale could solve one problem , but could create another.

George Winning presented a proposal how to use a WEB-based approach to publish information on inhibition. (Presentation in Appendix K)

In addition to own data and information, links to relevant info could be included to help the user. R. Nyborg said that IFE was willing to offer the testing procedures for corrosion inhibitors developed in a JIP (discussed in previous meetings).

The following committee to propose possible way forward was formed:

- George Winning
- Mohsen Achour
- Don Harrop
- Rolf Nyborg
- Rober Stalker
- Richard Carroll

Thierry Chevrot to take contact with P. McIntyre to discuss possible practical ways of making and updating such WEB-based system.

Pipeline Corrosion Integrity

T. Chevrot informed about ongoing work in NACE Task Group 370 on Pipeline Corrosion Management. (Presentation in Appendix L) This work is focused on US conditions and the idea of making an EFC document on “Industry best practice for corrosion management of pipelines” was discussed. In the following discussion, many expressed interest in participating in such work, but there is a need to define the scope. What pipeline systems should be included (onshore/offshore, gas/oil/water), external/internal corrosion, coatings, CP etc. It was noted that EFC WP16 “Cathodic Protection” had offered to contribute for the CP part of the document. The following group was formed to start the work and propose a possible table of content for a new document:

- Thierry Chevrot
- Mike Swidzinski
- Bijan Kermani
- Gro Stakkestad
- Carol Taravel Condat
- Sergio Kapusta
- Richard Carroll
- Simon Webster