Appendix 1

List of participants and excused persons

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Participants EFC WP15 meeting 15th September 2004 Nice

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Excuses received for the EFC WP15 meeting 15th September 2004 Nice

Appendix 2

EFC WP15 Activities

EFC Working Party 15 « Corrosion in Refinery »Activities

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

Publications

Publications

• EFC Guideline n°40 « Prevention of corrosion by cooling waters » (available in October 2004)

•EFC Guideline n° 42 Collection of selected papers (available spring 2005)

•EFC Guideline on corrosion in amine units

•EFC Guideline on Corrosion Under insulation

•Future publications
- Collection of papers of Eurocorr 2004 joint session WP 3 + 15
- other suggestions ?

Corrosion Under Insulation - EFC WP15 Guideline

Preface - Scope - Section I: Introduction what is CUI, European Issue

Section II: Cost analysis

Section III: Ownership and responsibility

Section IV: Unit prioritization

Section V: Reality check

Section VI: Risk analysis

Section VII: Challenge

Section VIII: Evaluation plan

Section IX: NDT screening techniques

Section X: Implementation

Section XI: Feedback of findings into main implementation plan

Appendix (i): NDT technique listing
Appendix (ii): Monitoring techniques
Appendix (iii): Application of new insulation and refurbishment issues
Appendix (iV): Design

Corrosion Under Insulation - EFC WP15 Activities

Inspection of Insulated Piping - Facts and figures

Scanraff Refinery, Chevron Texaco,….

CUI Best Practices Forum Discussion

CUI Mitigation Strategy

ExxonMobil Chemicals' mitigation strategy for CUI

Risk-Based Inspection approach to CUI

Information on the IOM January 2004 Conference

General consensus European program on CUI

EFC Working Party 15 « Corrosion in Refinery »Activities

WP Meetings

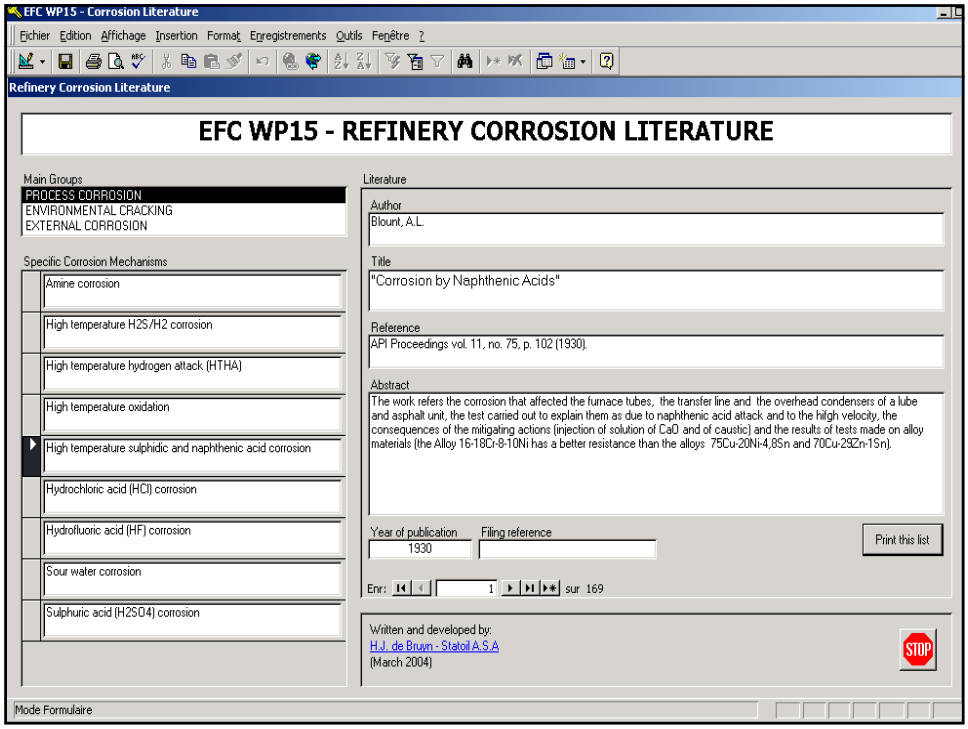
·One WP 15 working party meeting in Spring,
(late one on 8-9 April 2004 in Milan)

·One meeting at Eurocorr in conjunction with conference,

Eurocorr Conference sessions (September)
Refinery Corrosion Session
+ Workshops or Joint Session with other EFC WP parties
(as decided in 2003 spring meeting)
WP 3: High-Temperature Corrosion
WP 1: Corrosion Inhibition
WP 13: Corrosion in Oil and Gas Production

WP15 page in EFC Web site http://www.efcweb.org

WP 15 meeting September 15th 2004



EFC WP15 - Refinery Corrosion Literature

Main group: PROCESS CORROSION

Mechanism: High temperature H2S/H2 corrosion

NACE, "High Temperature Hydrogen Sulfide Corrosion of Stainless Steel", NACE Technical Committee Report, Corrosion, January 1968, pp. 27t - 31t.

NACE, "Iso-Corrosion Rate Curves for High Temperature Hydrogen-Hydrogen Sulfide", NACE Technical Committee Report, Corrosion, Vol. 15, March 1959.

Cooper, A.S. & Draauleks, A., "High Temperature Corrosion by Catalytically Formed Hydrogen Sulfide", Corrosion, vol. 18 (no. 8), 1962, p 2911 - 2981.

McConomy H.F., "High-Temperature Sulphidic Corrosion in Hydrogen-Free Environment", Proc. API, vol. 43 (III), 1963, p 78 - 96.

Cooper, A.S., "High Temperature Mercaptan Corrosion of Steels", Corrosion, vol. 19 (no. 11), 1963, p 396t - 401t.

Stranford K.N., "The Sulphidation of Metal and Alloys", Metall. Rev., vol. 138, 1969.

Cooper, A.S. & Gorman, J.W., "Computer Correlations to Estimate High Temperature H2S Corrosion in Refinery Streams", Mater. Prot. Perform., vol. 10 (no. 1), 1971, p 31 - 37.

Forouli, Z.A., "High Temperature Degradation of Structural Materials in Environments Encountered in the Petroleum and Petrochemical Industries: Some Mechanistic Observations", Anti-Corrosion, vol. 32 (no. 11), 1985, p 4 - 9.

Gutzeit J., "High Temperature Sulphidic Corrosion of Steels", Process Industries Corrosion - The Theory and Practice, NACE International, 1986, p. 367 - 372.

Gutzeit J., Merrick, R.D. & Sciarratella, L.R., "Corrosion in Petroleum Refining and Petrochemical Operations", Metals Handbook, vol. 13, ASM International (1989) 1262 - 1287.

First Announcement

EUROCORR 2005

European Corrosion Congress

European Federation of Corrosion
Event n.° 273

EFC

Corrosion Control
for Sustainable Development

4 - 8 September 2005
Lisbon, Portugal

SPM
Sociedade Portuguesa de Materiais

INTRODUCTION

EUROCORR is probably the most important event in Europe and a reference around the world on the subjects of corrosion and protection.
Covering a large number of topics on the areas of corrosion science and corrosion protection technology, EUROCORR 2005 will focus on "Corrosion Control for Sustainable Development" and will have a hot topic on "Corrosion Control in the Aeronautical Industry". Meetings of the EFC Working Parties will take place in parallel with the sessions of oral and poster presentations.
We invite you to come to Portugal and participate both in the congress and in the technical exhibition.

SCIENTIFIC TOPICS:

A. Corrosion and Scale Inhibition
B. Corrosion and Protection of Steel Structures
C. Corrosion by Hot Gases and Combustion Products
D. Nuclear Corrosion
E. Environment Sensitive Fracture
F. Surface Science and Mechanisms of Corrosion and Protection
G. Corrosion Education and Computer Applications
H. Corrosion Testing
I. Marine Corrosion
J. Microbial Corrosion
K. Corrosion in Concrete
L. Corrosion in Oil and Gas Production
M. Coatings
N. Corrosion in the Refinery Industry
O. Cathodic Protection
P. Automotive Corrosion
Q. Tribo-Corrosion
R. Corrosion Control in the Aeronautical Industry

LANGUAGE

English will be the official language of the conference.

PUBLICATIONS

A book of abstracts as well as the proceedings on CD-ROM will be provided on-site.

EXHIBITION

A Technical Exhibition will be organized, allowing manufacturers and users of materials, instruments, software and publications to contact and exchange information. Potential exhibitors should contact the Congress Secretariat for specific information.

DEADLINES

15 November 2004	Submission of Abstracts
15 February 2005	Notification of acceptance to authors
15 May 2005	Submission of full manuscripts

LOCATION

Lisbon, capital of Portugal for more than 700 years, stands by the estuary of the Tagus River and the Atlantic Ocean, on the westernmost limit of Europe. The city is favoured by a mild climate, with temperatures typically in the range 20-25°C during daytime in the beginning of September.

SOCIAL PROGRAMME

A social programme will be organized for the registered participants and accompanying persons, including a welcome reception and a congress dinner.
A large variety of sightseeing tours for accompanying persons will also be available.

CONGRESS SECRETARIAT

EUROCORR 2005
c/o Top Atlântico Operated by TopTours
Congress Department
Att. Mr. Vitor Alves
Av. D. João II, Lote 1.16.1
1990-083 Lisboa, Portugal
Ph.: (+351) 218 925 405
Fax: (+351) 218 925 406
e-mail: lisboa.congress@topatlantico.com
Congress Website: http://congress.topatlantico.com/eurocorr2005

http://www.eurocorr2005.org
http://www.efcweb.org/

European Federation of Corrosion

Workshop

Novel Approaches to the Improvement of High Temperature Corrosion Resistance

- *Alloy Modification*
- *Surface Treatment*
- *Test Methods and Service Conditions*
- *Modelling*

EFC-Event No. 275

Programme

October 27 – 29, 2004

DECHEMA House

Frankfurt am Main/Germany

www.dechema.de/efcws04

DECHEMA e.V.

Background

Novel, highly sophisticated approaches are needed in the **development of alloys and coatings** with improved resistance against high temperature environmental attack. The qualification of such materials and coating systems requires well-defined **testing methods** that account for the service conditions in specific applications. In order to minimise extensive experimental effort, a reasonable approach would be **modelling** to predict the corrosion rate, with supporting tools and verification experiments.

The present workshop in the now well-established EFC-series of high temperature corrosion events will focus on an assessment of the advances which novel approaches in these fields have brought to the knowledge of high temperature corrosion research. This seems to be particularly timely in the second half of 2004 since 4 large European joint research projects in this field will by then have come close to their conclusion. These projects are:

- **COTEST**
- **OPTICORR**
- **SMILER**
- **SUNASPO**

Considering the research aims in these projects the following topics will be addressed in the workshop:

A. Alloy Modification
B. Surface Treatment
C. Test Methods and Service Conditions
D. Modelling

The papers of the workshop represent a good balance between contributions from the mentioned EC-funded projects and novel projects from around the world. The conference proceedings will be published in the journal "Materials and Corrosion".

DECHEMA
Gesellschaft für Chemische Technik und Biotechnologie e.V.
Theodor-Heuss-Allee 25
D-60486 Frankfurt am Main
Germany

The NACE Italy , section of NACE INTERNATIONAL, organizes on the occasion of the recognition in Genoa what capital European of the culture 2004, his 2 ^ annual conference.
How custom, such conference is established to introduce, to discuss, to divulge, the connected problems to the technology of the corrosion.
The involvement of peoples that work with prevention and control of the corrosion is combined to the exhibition of products and services from the working Societies in the sector.
The papers interest all the sectors of the technology of the corrosion involving her thematic to it correlated (**Research, Corrosion, Corrosion Control, Coating, Cathodic Protection, NDE, Metallurgy, Materials and Services**).
Continuous evolution of technology calls us to give an exhaustive contribution : scientific, university, production and commercial, without forgetting the normative and institutional aspects.
The partecipation to the Conference becomes essential factor knowledge for deepened of this technology and remains the principal way to update the technicians that operated, to varied levels, in the different areas of the industry.
The Firms that present products and/or services have the possibility to intend and to introduce theirs last novelties in technological terms, doing grow the market and contributing so to an effectiveness cultural popularization.

Italia Section

NACE INTERNATIONAL THE CORROSION SOCIETY

presents

CORROSION 2004 - ITALIA

Genoa

Jolly Hotel Marina - Porto Antico
November 25 – 26, 2004

CALL FOR PAPER

AND

with sponsorship of
"ISTITUTO ITALIANO della SALDATURA"

Organizing Committee

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industry

Final papers can be even as "extended abstract"

- Abstracts deadline : May 31, 2004
- Papers deadline : September 30, 2004

The language is italian but the oral presentation can be in english.
The "abstracts", "extended abstracts" and complete papers must be in .doc format and sent it at under following addresses so like the Firms that want presented them products or services.

- Istituto Italiano della Saldatura
  Lungobisagno Istria 15 – 16141 Genova
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Appendix 3

"Achieving Improved Process Control and Real-time Corrosion Monitoring"

Russell Kane InterCorr Int.

Achieving Improved Process Control and Real-time Corrosion Monitoring

Dawn C Eden & Russell D Kane
InterCorr International Inc.
Houston, Texas 77014

Eurocorr 2004 – Working Party 15 (Corrosion in the Refining Industry)
September 15, 2004; Nice, France

NACE CTW 2004 - Technology Exchange STG 34
September 14, 2004; Phoenix, Arizona

InterCorr INTERNATIONAL  SmartCET

Cost Factors in Refinery Operation

Issues affecting refinery equipment, corrosion and profitability:

- Quality of incoming crude (lower feed cost may relate to higher impurities and processing/maintenance costs)
- Efficiency of treatments (e.g. desalting, dehydration)
- Chemical supply and management
- Performance data usually gathered from discrete data sources, e.g.
  - Distributed Control System (DCS) Data
  - Operational Logs or Notes
  - Chemical Supplier-Provided Data
  - Corrosion Monitoring Data (usually off-line and retrospective - coupons or electrical resistance)
  - NDT and Visual Inspection Data

Managing Plant Performance

Assessment of mostly off-line data makes assessment difficult.

A common approach is:

- Correlate infrequent, historical or symptomatic data to plant process data….can provide misleading “theories”
- Make decisions based on “Best Guess”, retrospective plant experience….often based on incomplete information

The goal must be integration of accurate *online, real-time* data that is *directly relevant* to equipment performance, i.e.

- Monitor and process control BEFORE substantial damage has occurred.
- Accurately assess the impact of allowed damage vs. long term serviceability
- Minimize equipment downtime….maximize productivity

Real-time Problems Need Real-time Solutions

- *On-line, real-time* data from strategically located sensors provide immediate feedback of corrosion conditions in plant (e.g. crude unit, desalter, amine unit, key heat exchangers)
- Resulting ‘Key Performance Indicators’ enable optimization of process control and chemical treatment programs to limit corrosion, e.g.
  - Real-time detection and alarming of key events, e.g. pitting activtity - shortens response time, enables proactive control and limits damage
  - Optimize chemical treatment programs - enables observation of real-time cause & effect, helps ensure the right level of treatment gets to where it is needed

A Brief Review of Available Technologies

Many corrosion assessment methods are used routinely in petrochemical and chemical plant, but many have limitations:

NDT, NDE Inspection →	Off-line (or online), can be accurate, but rely upon: 1) existence of substantial defects for detection 2) quality of inspector
Weight Loss Coupons →	Off-line, can be accurate, but: 1) exposure time is long (~3 months) 2) labor-intensive analysis required
Electrical Resistance →	Offline (or online), can be accurate, but: 1) only detects general corrosion 2) trade-off between sensitivity and probe lifetime

- Experience has shown that:
  - 70-90% of all corrosion failures result from localized corrosion
  - 90% of corrosion occurs in 10% of the time

A Brief Review of SmartCET® Technologies

The need is on-line, real-time corrosion detection coupled with evaluation of both general and localized corrosion

Electrochemical Noise (ECN) →	For Pitting Factor and other parameters related to localized corrosion	$\frac{\sigma_i}{I_{corr}}$
Linear Polarization Resistance (LPR) →		
Harmonic Distortion Analysis (HDA) →	For more accurate Corrosion Rate and other parameters related to general corrosion	B value

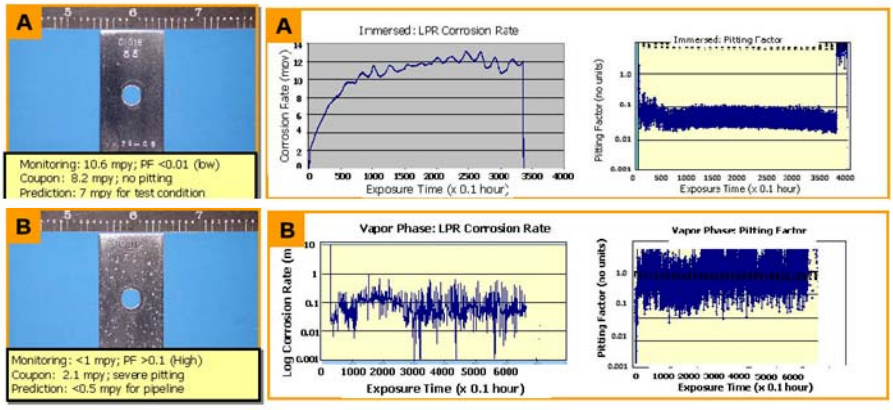
Features:

- automated data acquisition and analysis cycle – every 7 minutes
- low power requirements; easily adapted to Intrinsically Safe applications
- simple interface to SCADA, process control, process information management systems
- hardwire or radio communications, local or remote, mains or solar power

How is real-time, online technology Implemented?

Example Data: Dehydrated Gas Environment

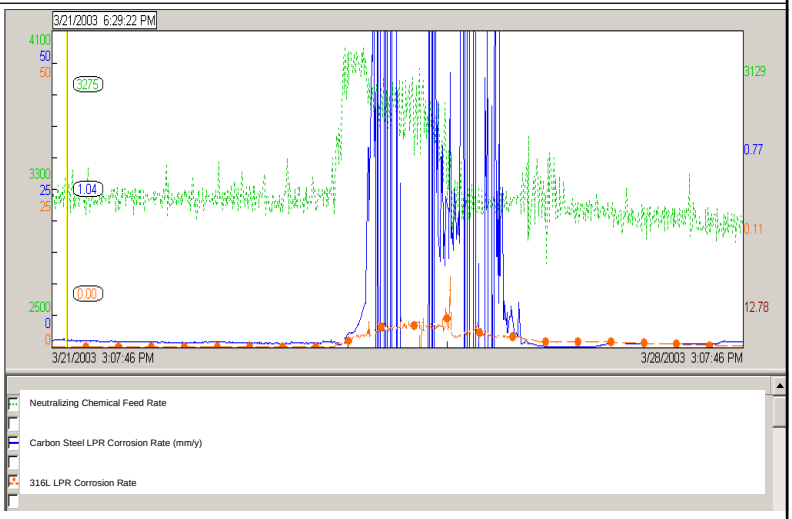
Corrosion Monitoring vs. Coupons



- Excellent agreement between coupon corrosion rates and pitting susceptibility and online corrosion monitoring data.

Example Data: Correlation with Process & Operations

Correlation between the feed rate of a neutralizing chemical and the corrosion rates of carbon steel and 316L.

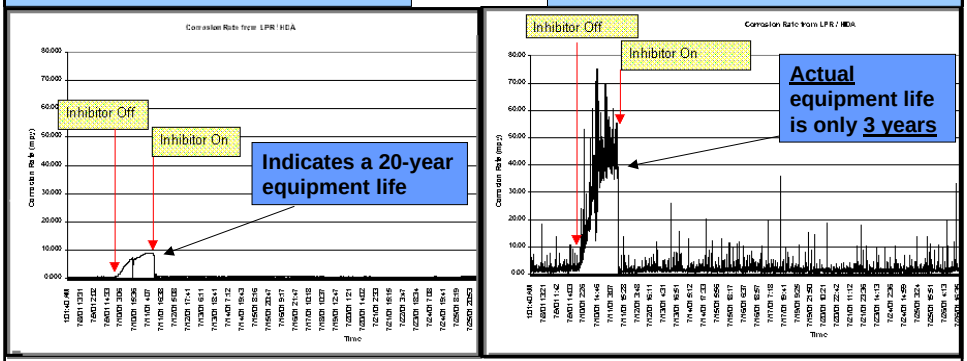


More on real-time, online plant monitoring – Paper 15-O-367 9:40 am Thursday

Example Data: Inhibitor Optimization in Sour System

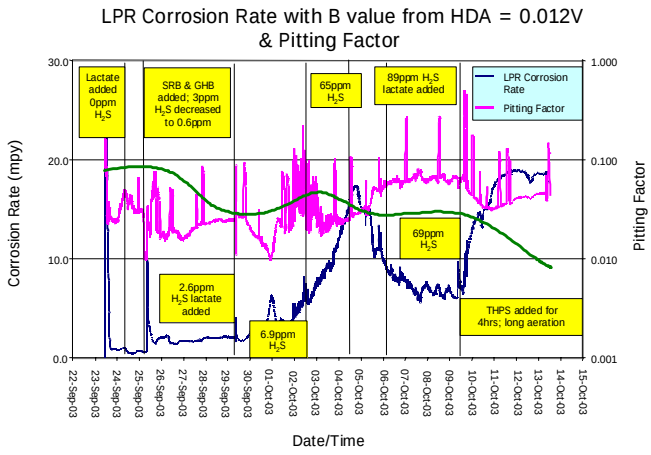
Corrosion Rate as seen using most corrosion instruments -
30 mV default "B" value

Corrosion Rate using actual "B" value determined real-time



This data demonstrates the value of field instrument B value measurement - accuracy is critical

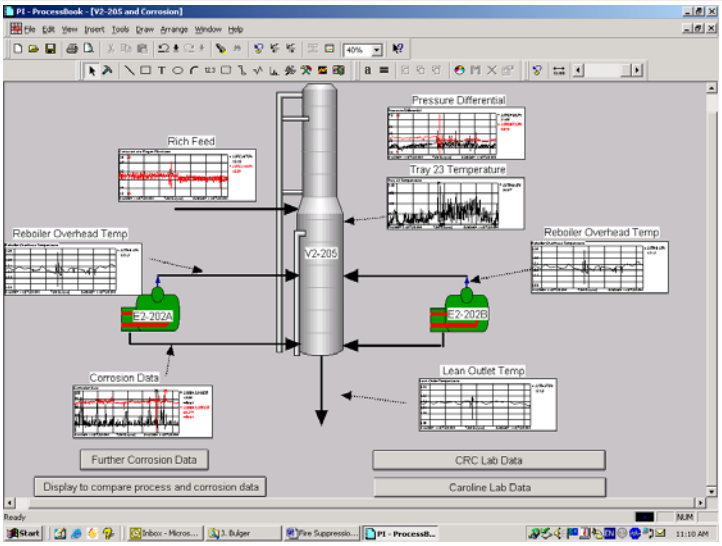
Example Data: Influence of Microbiological Activity



Electrochemical activity can vary according to the type of surface film - SmartCET can also show the effects of scaling & under-deposit corrosion

More on real-time, online MIC monitoring – Paper 10-O-366 14:40 Thursday

Integration / Correlation with Process Variables



Conclusions

- Refineries, petrochemical and chemical plants operate complex processes that can ***benefit or suffer*** due to variations in the quality of primary feedstocks, operational and other chemical changes
- 70-90% of all corrosion failures occur due to localized corrosion, and typically 90% of corrosion occurs in 10% of the time
- All monitoring and measurement data is important, but it is the on-line real-time evaluation of direct measurements such as general corrosion and pitting that can leading to improved process control, positively impacting equipment availability and plant profitability
- Technology is available that can measure these key variables, providing a simple and direct data output thereby enabling rapid uptake of technology by the plant operators
- This technology is proven in numerous field applications, worldwide and across industries

Appendix 4

"Continuous Active Corrosion and HIC risk Measurement"

Franck Dean Ion Science

HYDROSTEEL 7000

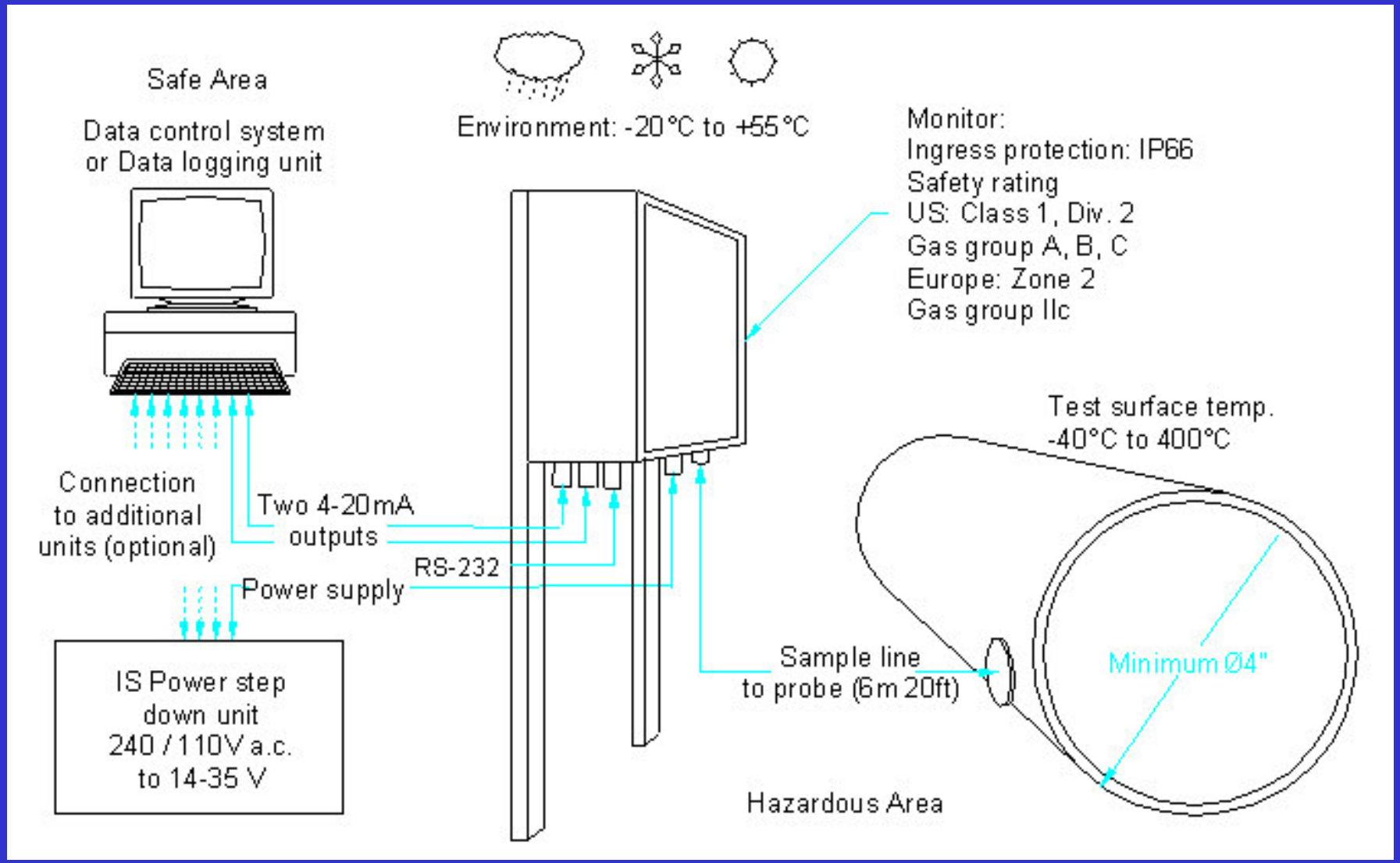
Continuous Active Corrosion and HIC risk Measurement

Mapping hydrogen flux over time in high criticality areas

For WP15-Eurocorr 2004, Nice, France

Ion Science Ltd

Hydrosteel 7000 Fixed Installation



Hydrosteel 7000 Fixed Installation

Features

- A non-intrusive, IS, IP Hydrosteel monitor
- Self diagnostics
- One year's hands free operation
- Auto-data logging
- 4-20 mA output of flux and temperature

Applications

- Sour, HFA, and all high temperature corrosion monitoring
- Inhibitor treatment and corrosion control
- Use of opportunity crudes
- HIC damage risk assessment and avoidance

Benefits

- Identify corrosion issues in near real time
- Reduce production shutdowns
- Save on inhibitor costs
- Save on feedstock costs
- Avoid unscheduled shutdowns

Frank.Dean@ionscience.com

Appendix 5

Corrosion Under Insulation

Sections and contributors of the Guideline

EFC CUI Guideline

	Contributor 1	Contributor 2
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Section VII: Challenge	Hennie de Bruyn, hdb@statoil.com	Stefan Winnik stefan.winnik@exxonmobil.com
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Appendix (ii): Monitoring techniques	Maarten Lorenz maarten.lorenz@shell.com	
Appendix (iii): Application of new insulation and refurbishment issues	Stefan Winnik stefan.winnik@exxonmobil.com	
Appendix (iv): Design	Terry Hallett terry.hallett@shell.com	