Introduction to the

Institute of Corrosion

Dr Philip Enegela  
*CEng, MIMMM, MICorr*

On behalf of

ATKINS  
Member of the SNC-Lavalin Group

University of Aberdeen  
08/09/2017
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About Corrosion

Corrosion costs (general):

• 276 billion USD per year for total direct cost of corrosion in the United States; equivalent to 3.1% of GDP.

(Source: NACE – The Worldwide Corrosion Authority.)

• Corrosion cost to the UK is about 4% of GDP

(Source: Institute of Corrosion, ICorr, U.K.)

Corrosion costs (Oil and Gas industry):

• 7 billion USD per year for gas and liquid transmission pipelines.

• 1.4 billion USD per year for oil and gas exploration production.
About Corrosion

Consequences of Corrosion:

• Loss of mechanical strength and structural failure or breakdown

• Hazards or injuries to people

• Environmental impact due to leakage from vessels and pipes

• Loss of time in availability of industrial equipment

• Reputational damage
About Corrosion

What is Corrosion?

• Corrosion is the deterioration of a substance, usually a metal, or its properties because of a reaction with its environment. (NACE)

• Physicochemical interaction between a metal and its environment which results in changes in the properties of the metal and which may often lead to impairment of the function of the metal, the environment, or the technical system of which these form a part. (ISO 8044)
About Corrosion

Corrosion Triangle:

- WATER
- CORRODENT
- METAL

Corrosion Control:

\[
\text{METAL} + \text{WATER} + \text{CORRODENT} = \text{CORROSION}
\]

\[
\text{METAL} + \text{WATER} + \text{CORRODENT} = \text{NO CORROSION}
\]

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\text{METAL} + \text{WATER} + \text{CORRODENT} = \text{NO CORROSION}
\]

\[
\text{METAL} + \text{WATER} + \text{CORRODENT} = \text{NO CORROSION}
\]

Design the material

Control the environment

Design a barrier
## About Corrosion

### Corrosion Control Engineering

<table>
<thead>
<tr>
<th>Factor</th>
<th>Controlling Method</th>
<th>Barrier</th>
<th>Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductivity</td>
<td>Stop/slowdown electrons</td>
<td>Non-conducting coat/paint</td>
<td>Coating/Painting Engineer/Inspector</td>
</tr>
<tr>
<td>Conductivity</td>
<td>Reduce conductivity</td>
<td>Keep the process dry</td>
<td>Process Engineer</td>
</tr>
<tr>
<td>Electrochemical</td>
<td>Apply current</td>
<td>Cathodic protection</td>
<td>CP Engineer/Inspector</td>
</tr>
<tr>
<td>reaction</td>
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</tr>
<tr>
<td>Oxygen</td>
<td>Stop/slowdown Oxygen</td>
<td>Barrier coating/paint</td>
<td>Coating/Painting Engineer/Inspector</td>
</tr>
<tr>
<td>Anodic reaction</td>
<td>Electronegativity</td>
<td>Corrosion resistant metal</td>
<td>Material/Corrosion Engineer</td>
</tr>
<tr>
<td>Electrochemical</td>
<td>Stop/ reduce reaction rate</td>
<td>Corrosion inhibitor</td>
<td>Chemical/Corrosion Engineer</td>
</tr>
<tr>
<td>reaction</td>
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<td></td>
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</tr>
<tr>
<td>Electrochemical</td>
<td>Stop/ reduce reaction rate</td>
<td>Passive layer</td>
<td>Material/Corrosion Engineer</td>
</tr>
<tr>
<td>reaction</td>
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</tbody>
</table>
About Corrosion

Types of corrosion

• There are more than 45 types of failure mechanisms in 5 categories as per API 571 only in oil and gas industries

• Mechanical and Metallurgical
• Uniform or Localized Loss of Thickness
• High Temperature Corrosion
ICorr (http://www.icorr.org/) is a learned society and registered charity that has been serving the corrosion science, technology and engineering community since 1959 in the fight against corrosion.
About ICorr

Technical divisions:

• Corrosion Science Division
  ✓ Corrosion Symposium (5-6 September 2016 - 57th Corrosion Science Symposium)

• Corrosion Engineering Division
  ✓ Forums
  ✓ Working groups (Cathodic protection - Nuclear - Coatings - Oilfield chemicals - Water treatment - Corrosion in Concrete)

Regional Branches:
Continued Professional Development (CPD)

• CPD comprises learning activities that you undertake to gain knowledge and experience in order to help you in your professional career as a
  – Chartered Scientist or
  – Chartered Engineer

• Additional to the normal duties of your day-to-day employment such as,
  – training days
  – professional mentoring of colleagues or others
  – attendance at conferences

• mycareerpath® (CPD record database)
About ICorr

Training and Qualification

• ICorr Certification Scheme
  – Painting Inspector (Level 1/2/3)
  – Coating Inspector (Level 1/2)
  – Pipeline Coatings Inspector
  – Insulation Inspector
  – Fire Proofing Inspector

• Cathodic Protection (CP) Certification Scheme,
  – Cathodic Protection Technician (Level 1/2/3)
  – professional mentoring of colleagues or others,
  – attendance at conferences.
ICorr (Aberdeen Section)

2017-2018 Session Committee

**Chair**: Dr Yunnan Gao

**Vice Chair**: Hooman Takhtechian

**Secretary**: Dr Nigel Owen

**Treasurer**: Alistair Seton

**Event Co-ordinator**: Amir Attarchi

**Publicity Secretary**: Stephen Tate

**University Liaison / CPD Officer**: Dr Philip Enegela

**Committee Members**: Dr Muhammad Ejaz, Frances Chalmers, Bryn Roberts, Dr Abdulmotaleb Suleiman
ICorr (Aberdeen Section)

https://sites.google.com/site/icorrabz/home

Institute of Corrosion Aberdeen Branch

Welcome to the Aberdeen branch of the Institute of Corrosion

Thanks to our branch sponsors, the Aberdeen branch of the Institute of Corrosion is able to host a technical programme of monthly presentations from September through to May.

Institute of Corrosion Aberdeen branch meetings begin at 18:00 with a complimentary light buffet and the opportunity to network with other corrosion professionals, followed by the technical presentation at 18:30. The exception this year is the April 2014 meeting which begins at 17:30 for a 18:00 start, after the Marine Corrosion Forum.

Our meetings are typically held on the last Tuesday of the month at the Palm Court Hotel, 81 Seafield Road, Aberdeen, AB15 7YX.

The Institute of Corrosion is recognised by the Institute of Materials, Minerals and Mining (IOM3), British Institute of NDT (BINDT) and by the Institute of Marine Engineering, Science and Technology (IMarEST) as offering technical presentations that contribute to an individual member’s Professional Development requirements.

Details of local Aberdeen events from the Institute of Corrosion (ICorr) are shown in our Technical Programme.

Subscribe to the Institute of Corrosion
ICorr (Aberdeen Section)

https://sites.google.com/site/icorrabz/resource-center

<table>
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<th>Downloads</th>
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<tbody>
<tr>
<td><strong>U 2016/2017 ICorr Aberdeen Presentations</strong></td>
</tr>
<tr>
<td>2017-01-31 Dr N Faisal and Dr G Droubi (RGU)</td>
</tr>
<tr>
<td>2017-02-28 Dr Jake Davies, Permasense, NER</td>
</tr>
<tr>
<td>2017-05-30 Simon Daly of Hempel, A Film Coating</td>
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</tbody>
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ICorr (Aberdeen Section)

https://sites.google.com/site/icorrabz/calendar

Local Technical Programme

ICorr Aberdeen Branch Programme of Events

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday, 25 September</td>
<td>18:00</td>
<td>Joint TWI &amp; ICorr Aberdeen Branch Meeting</td>
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<tr>
<td>Tuesday, 31 October</td>
<td>18:00</td>
<td>ICorr Aberdeen Branch Meeting</td>
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<tr>
<td>Tuesday, 28 November</td>
<td>18:00</td>
<td>Joint IOM3 and ICorr Aberdeen Branch Meeting</td>
</tr>
<tr>
<td>Tuesday, 30 January 2018</td>
<td>18:00</td>
<td>ICorr Aberdeen Branch Meeting</td>
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<tr>
<td>Tuesday, 27 February 2018</td>
<td>18:00</td>
<td>ICorr Aberdeen Branch Meeting</td>
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<tr>
<td>Tuesday, 27 March 2018</td>
<td>18:00</td>
<td>ICorr Aberdeen Industrial Visit - BOOKING REQUIRED</td>
</tr>
</tbody>
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Displaying events until 15/6. [Look for more](#)
The third meeting of 2017 was held on Tuesday the 28th March with 30 attendees who enjoyed some very useful presentations including: Tony Adkins, SPE, CEng, LLiti, LRAE, MIMechE, and Paul Brookes, IChemE, on Conductive coatings for corrosion protection. The event was also an excellent opportunity to discuss and share experiences with others involved in the field. The following week on the 30th March, Aberdeen Branch held another successful event with a presentation by Dr. Colin Aitken on "Corrosion Monitoring: A New Approach". The event was well attended and provided useful insights into the latest developments in corrosion monitoring and management.

This event created a tremendous amount of interest from attendees, who were eager to learn more about the latest advances in the field. The session was followed by a networking session where attendees were able to discuss their experiences and knowledge with other professionals.

This Branch News article was submitted by the Aberdeen Branch of the Institute of Corrosion, and was published in the May/June 2017 issue of Corrosion Management.
## ICorr Aberdeen Events 2017-2018

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Topic</th>
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<tbody>
<tr>
<td>26th September ‘17</td>
<td>Susan Jacob – CAN/Total</td>
<td>Joint TWI Event. An Investigation into the Wrinkling Phenomenon on CRA Pipelines and its impact on Pipeline Integrity</td>
</tr>
</tbody>
</table>
| 31st October ‘17   | IMG and Walker                         | Special Composite Wrap Event. Paper 1: Established Composite Engineering in 2017  
Paper 2: Composite Repairs – A Long Life-Time Repair Solution (Walker) |
| 28th November ’17  | Oil and Gas Technology Centre and TRAC | Paper 1: Managing Corrosion Under Insulation using novel technologies (OGTC)  
Paper 2: Topic on work to address corrosion under composite repairs (TRAC) |
| 27th February ’18  | LUX Assure                             | Function-related dosage of corrosion inhibitors; the development of an on-site, operator deployable technology |
| 27th March ’18     | Element Materials Technology           | Industrial Visit to Element’s New H2S / Sour Service Lab              |
Paper 2: A Newly Built Corrosion Management Strategy – Lessons Learned (BP/Oceaneering) |
| 29th May ‘18       | Sonomatic                              | Industrial Visit to Sonomatic                                         |
ICorr Aberdeen Events

ICorr Aberdeen Branch Meeting
Palm Court Hotel
81 Seafield Road, Aberdeen AB15 7YY
18:00 Complimentary Light Buffet & Networking
18:30 Technical Presentation

Tuesday 28th February, 2017

Topic: Monitoring High Temperature Corrosion Attack: Correlation between Corrosiveness and Results from Online Corrosion Monitoring

Presenter: Dr Jake Davies (Permasense)

Online monitoring of corrosion is fast becoming industry best-practice and used as a means of gathering asset valuable integrity data. These systems are especially useful when the asset is difficult to reach. This paper will demonstrate how data delivered by an online corrosion monitoring system correlated with micro-changes in the measured corrosion influencing variables during a period of high temperature corrosion attack. The monitoring system delivers both wall thickness measurements and a measure of change in shape of the ultrasonic back wall reflection over time (Permasense Shape Indicator) directly to the engineer’s desk for linkage with other process information via DCS/PI systems.

The event is Free for members and non-members to attend.

Join our events mailing list at https://sites.google.com/site/icorrabz

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http://www.icorr.org/branches/aberddeen.shtml
ICorr Aberdeen Events
Corrosion Awareness Course

• A full-day course comprises a number of lectures (5 to 6), each of which talks about a different aspect of corrosion and gives basic information on corrosion principles, corrosion mechanisms and corrosion control

• The objective of this course is to help understand corrosion as process and to raise awareness regarding corrosion management. The course takes place each year, normally in the last week of August

• The lectures are delivered by renowned Corrosion Engineers / Scientists and are provided on a voluntary basis

• Target audience are graduate engineers and non-corrosion engineers but work closely with corrosion (e.g. integrity engineers, inspection engineers, etc.), as well as engineering students

• Priority is given to candidates nominated by Sponsors, on a “first-come, first-served” basis

• The course is hosted by ICorr Aberdeen Branch through its sustaining and branch sponsorships

• Link to lectures from previous meetings:
  
  https://sites.google.com/site/icorrabz/resource-center
ICorr Aberdeen Events
Corrosion Awareness Course
ICorr Membership

• **Develop links** with business and professional bodies who have similar interests.

• **Enjoy the support** of an enthusiastic and experienced organisation.

• **Participate in the advancement of corrosion control** in all its forms.

• **Participate** in Branch and Divisional activities.

• **Leads to professional qualification** (FICorr, MICorr, TICorr) or certification as technicians and inspectors (Technician 1, Inspector levels 1 to 3).

• **Corrosion Awareness course** free spaces offered to students every year.

• **Keep up to date** with corrosion and corrosion control activities.
ICorr Membership

- Free student membership

http://www.icorr.org/membership/student-membership.phtml

- Show proof of full time enrolment at an approved science or engineering based study program.
- Submit completed form and proof of enrolment.

**ICorr Membership**

The Newton Building, St George's Avenue, Northampton NN2 6BJ
TEL: +44 (0) 1604 893823 - FAX: +44 (0) 1604893875
Email: admin@icorr.org - Web site: http://www.icorr.org

APPLICATION FOR STUDENT MEMBERSHIP
(Please TYPE or PRINT in black ink as the form will be photocopy)

<table>
<thead>
<tr>
<th>Surname</th>
<th>Forename/Maiden Name</th>
<th>Change in last 12 months</th>
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PRIVATE ADDRESS
Including postcode

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<th>UNIVERSITY</th>
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COURSES

QUALIFICATIONS

UNIVERSITY ADDRESS
Including postcode

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<td>Home</td>
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<td>Business</td>
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<tr>
<td>Mobile</td>
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<tr>
<td>Email</td>
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</table>

Email (for correspondence): [ ]

Which Address Do You Want To Use For Correspondence And The Journal (Home/University)

DECLARATION (to be signed by all applicants)

I hereby confirm that I have an interest in the practice of corrosion technology and/or science and undertake to comply with the institute's rules of association and by-laws.

Signed: [ ] Date: [ ]

Fees:
- Show full-time students are eligible for ICorr membership at no cost

To qualify for the ICorr student membership and benefits, you must:

1. Show proof of course schedule and student ID of enrolment as a full-time student on an approved science or engineering based study programme.

2. Submit proof of student eligibility on an annual basis of renewal. (Seven years is the maximum length of time an individual may retain student status.)
Key Information

• For further information about the institute, visit the ICorr website:
  
  www.icorr.org

• For further information about the activities of the local section, visit Aberdeen section page on
  
  https://sites.google.com/site/icorrabz/
  
  or send an email to
  
  icorrabz@gmail.com
ICorr Aberdeen Branch Meeting

18:00 on Tuesday 26th September, 2017
Palm Court Hotel
81 Seafield Road, Aberdeen AB15 7YX
18:00 Complimentary Light Buffet & Networking, 18:30 Technical Presentation

A Joint Technical Meeting with TWI (The Welding Institute)

Topic: An Investigation into the Wrinkling Phenomenon on Corrosion Resistant Alloy (CRA) Pipelines and its impact on Pipeline Integrity

Presenter: Susan Jacob (CAN Offshore Limited)

The event is Free for members and non-members to attend.

Join our events mailing list at https://sites.google.com/site/icorrabz

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https://www.icorr.org/events/category/aberdeen-branch/list/
Thank you.