



## Failure Analysis Services

### The Challenge

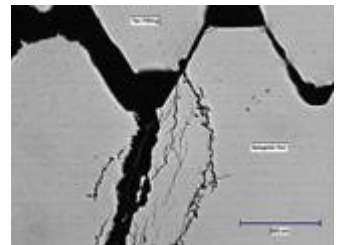
Component failures can represent significant safety, health, environmental and business risk to the integrity of any operation including upstream oil and gas production, and downstream refining facilities.

### The Solution

A failure analysis investigation identifies a root cause mechanism. Corrective actions based on the findings can prevent repeat failures. Findings may also assign responsibility, in the case of product liability and litigation, to a supplier, an individual, or a group. Component failures may be attributed to poor design or manufacture, choice of materials, or the operating environment. Failures can occur due to mechanical overload under static or dynamic load conditions. These mechanical type failures are classified as ductile fractures, brittle fractures, or fatigue fractures resulting from cyclic loading. Failures may also be attributed to corrosion which is the result of allowing exposure of unprotected metallic surfaces to specific environments that can cause degradation. Typical forms of corrosion may include uniform, pitting, corrosion under insulation, sweet corrosion, sour corrosion, galvanic corrosion.

Common steps in any investigation include:

- A review of background information including design documents and service history.
- Documentation of the as received condition using a general visual inspection and a photographic record.
- Relevant non-destructive tests such as dye penetrant or magnetic particle inspections.
- Compositional analysis to determine if the component meets specification.
- Mechanical tests to determine if the component has the specified strength and hardness.
- Metallurgical testing to confirm if the material was properly heat treated to provide the required strength.
- Fractography to study surface morphology of a fractured or cracked surface and classify the loading mechanism.
- Metallurgical analysis for characterizing corrosion degradation/ cracking as transgranular or intergranular.



EM&I, with Court Recognized Expert Witnesses, has the expertise and experience to help you understand your component failures and to ensure the reliable operation of critical assets.

### The Benefits

Facility owners may empower themselves with an understanding of why components fail, gain increased confidence in asset integrity, confirm RBI predictions, and improve planning for inspection, repair and maintenance activities.

### Track Record

We measure our performance through systems like FPAL and unsolicited testimonials. Our proven track record of satisfied Clients is available on our Website.

Further information is available from your nearest EM&I office who will be pleased to discuss your particular needs.

Case Histories and References, demonstrating our capabilities and Client satisfaction, are available on our Website.

### Credentials

Health & Safety – EM&I has an outstanding HSE record and has been granted the RoSPA President's Award in recognition of winning eleven consecutive RoSPA Occupational Health & Safety Gold Awards including five Gold Medals and numerous other international awards.

Other safety awards include IFAP Safe Way Safety Achievement Awards and the Leith Offshore Safety Award.

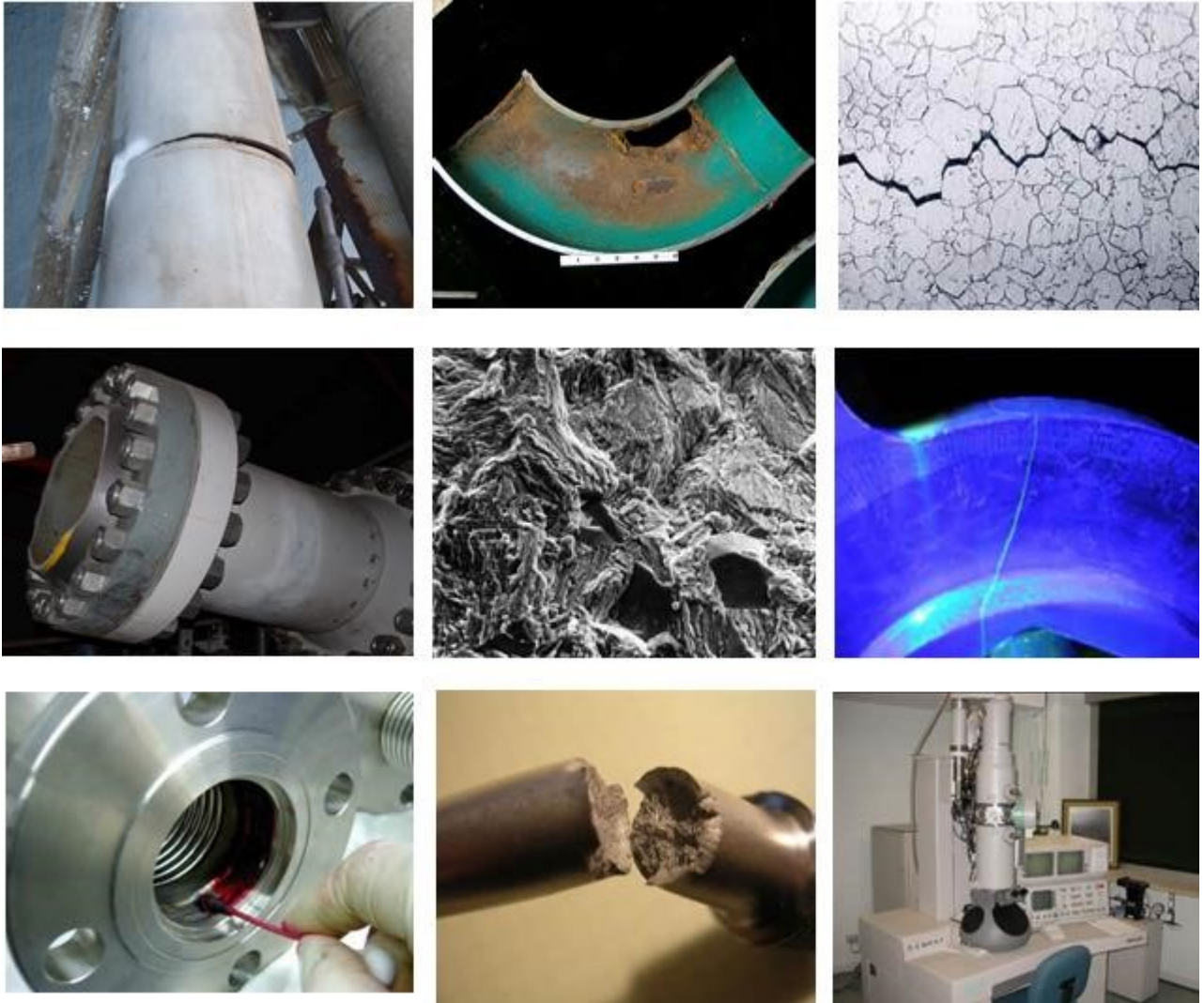
Quality – We assure quality through accredited ISO 9001 and ISO 17020 management systems and seek continuous improvement by measuring Client satisfaction through FPAL and regular Stewardship Reviews.

Compliance – EM&I's methods are approved by Classification Societies and accepted by regulators worldwide.

Rope Access – EM&I have been a Full Member of IRATA since its inception in the 1980s.

HITS JIP – EM&I have a leadership role in the Hull Inspection Techniques and Strategy (HITS) JIP whose members include Oil Majors, Classification Societies, Regulators, Lease Operators and service companies.

## Failure Analysis Services



### Integrated Services

EM&I's proven technical and project management experience means we can successfully deliver complete projects thus letting you focus on your core business.

Our in-house service capability includes Asset Integrity Systems, Inspection, NDE, Maintenance & Repair, Corrosion Management, Cathodic Protection, Safety, Environmental and Engineering services.



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