



European Technology Development Ltd

Working for Power, Petrochemical, and Process Plant

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- ### ETD Services
- Plant Life Assessment / Extension
 - Stress Analysis
 - Training / Courses
 - Technology Development
 - Plant Cycling
 - Crack Assessment
 - Risk Based Maintenance
 - Consultancy

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Who are We ?

ETD is an independent company registered in England. It is a highly innovative engineering service provider and consulting company offering technical support services to clients in high temperature industry (power, CCGT, petrochemical, process and waste incineration plant) and renewable and small scale energy systems. ETD expert support includes provision of services in:

Asset Integrity

- Structural Stress Analysis,
- Defect / Crack Assessment (using standard and in-house software packages),
- Plant Remaining Life Assessment and Extension,
- Weld assessment and weld repair issues,
- High temperature corrosion in industrial environments.

Materials Advisory and Selection Service

This is provided for all types of high

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temperature plant (including new materials for higher output higher efficiency plant (P91/92, P122, T23 etc.).

Risk Based Maintenance/ Management

Including inspections and plant overhaul management and outage planning.



Plant Cycling and Maintenance

Maintenance issues and cost analysis for power plant subjected to steady load and cycling duties.

Fitness-for-Service Assessment

This is regularly undertaken both for power and petrochemical plant.

Probabilistic Assessment

Leading expertise in this area. Undertake work for industry clients worldwide for design and life assessment.

TECHNOLOGY DEVELOPMENT

The company works through a corporate model of core staff and a pool of internationally known technical experts with practical experience, background and expertise in power, petrochemical and process plant.

The company **technology base** stems from the plant experience of its staff and ETD involvement in small and large scale (multi-million Euro) technical, product development and R&D projects. These are either sponsored by a single or consortia of international industry (see list on the back page) or by national government or international bodies such as the European Commission. *ETD has been leading some of the largest EC funded projects and consortia of industry.*

TECHNOLOGY TRANSFER

ETD is keen to transfer technology and to this effect it regularly organises **training courses** and **interactive workshops** in the UK and host countries and companies on request.



PLANT SERVICES

Risk Based Maintenance

The past ten years have seen extensive changes in the power generation industry. Deregulation, competition, and environmental pressures have all had a major impact on the way the industry conducts its business. The current focus on profitability has yielded significant changes to maintenance practices including how overhaul content is determined and how the work is scheduled and carried out. Risk based maintenance and inspection prioritise components for inspection and regular

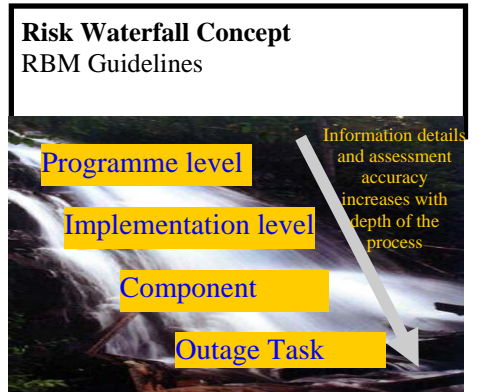
maintenance by quantifying their impact on the safety, reliability and efficiency of the unit.

Risk Based Approach

- 1) Identify and measure risk levels
- 2) Prioritise Tasks
- 3) Reduce Risk by Focused Inspection/Maintenance

ETD together with its work partners in the USA has established RBM methodology (Waterfall Concept) and experience which can ensure availability, reliability, safety and operational flexibility while keeping maintenance costs low. These offer the advantages of an improved knowledge base, prioritization, a

structured methodology for decision making, consistency, optimized maintenance and inspection and substantial cost savings without increasing risk of component failure.



Two Shifting or Cyclic Operation of Conventional Power Plant & CCGT s

Two shifting or cyclic operation of power plant is becoming common due to privatisation and increased competition in the electricity generating industry. As a result ETD has recently completed two large projects / studies in this area both sponsored by international industry.

The first project concerned the conventional steam plant and the second **combined cycle gas turbines (CCGT)**. Both projects involved partners and sponsors from Europe, USA and Canada. They were aimed at reviewing damage to plant components due

to this mode of operation and its effect on increased maintenance. The projects involved review of **management, manpower** and **cost** implications. The Final ETD Reports in both cases provide check lists and good practices as essential guidelines for economical and



safe two-shift operation of conventional power and CCGT plant and optimisation of start up times.

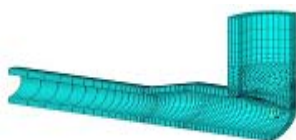
The first project was followed by an international Conference on this issue held in London and this resulted in the publication of two other ETD reports/ proceedings. The second project included overview of both hot section and heat recovery steam generator (HRSG) plant

Maintenance Advisor Software (MAS) Based on this background ETD has now developed its popular maintenance software for HRSG & conventional plant for operation both in **base load** and **cyclic mode**.

Asset Integrity Services (Plant Life Assessment, Stress analysis, Defect Assessment)

The pressures being placed on industry to 'sweat the assets' puts ever more stringent demands on the plant and components. ETD's **Asset Integrity Services** assist clients in making informed decisions on the operation and maintenance of their plant and to manage the risks their operations place upon the assets they own or operate.

Asset Integrity Services offers an array of tools, skills and techniques for assessment and analysis of component in the areas shown on page 1.



ETD's Asset Integrity Services are internationally

recognised in the field of **defect assessment** at ambient and elevated temperatures. The company has developed a range of effective and robust in-house tools, based on both *deterministic and probabilistic methods*, that incorporate fracture assessment procedures (BS 7910, BS 5500, R6, R5 and A16) and our own practical field experience. In addition., ETD provides excellent stress analysis services for designers and life assessors using in house data packages and standard FEM tools.

Many industries are faced with an increasing array of ageing plant and equipment close to or even beyond original design life. ETD provides Life Extension, Failure Analysis and Material Selection services to support its continued component operation, to quantify the remaining period of safe operation, and advise on repair or replacement strategies.

TRAINING / TECHNOLOGY TRANSFER

TRAINING COURSES, WORKSHOPS, SEMINARS

ETD specialises in the organisation of **Training Courses, Interactive Workshops and International Conferences** both in the UK and overseas. The topics / issues have ranged from high temperature crack assessment, through power plant cyclic operation to weld repairs in high temperature materials for waste incineration plant, Risk Based Maintenance probabilistic assessment, and renewable energies. ETD staff have produced a number of review articles, books and special issues of major international journals.

Plant Life Assessment Courses London, Every year

This series of courses has been formulated to emphasise the practical implementation of **Power & Petrochemical Plant Life Management**. These yearly courses have been designed as sequential, starting from Plant Operation (LMF1), through Welded Component Behaviour (LMF2) to Crack Assessment (LMF3). This allows the participant to initially establish a sound knowledge base and then build on this a greater understanding of the subtleties of effective Life Assessment and Management. The courses have been designed such that each can be used as *stand-alone* or all can be taken together to expand knowledge base/ update on recent developments.

These courses include **interactive workshops** and **practical examples**. The course dates and full programmes can be seen at the ETD web site.

For other courses (HRSGs, petrochemical plant, turbines, boiler maintenance, P91 etc. or training in other countries) please visit our web site or write to: enquiries@etd1.co.uk

For the latest info on ETD's training courses/ workshops/conferences and Registration

Visit our website: www.etd1.co.uk or E-mail: enquiries@etd1.co.uk

Training Course

Life and Fitness-for-Service Assessment of Refining and Petrochemical Plant

19 - 20 April 2007

Venue: London

This repeat course will cover various issues affecting the performance and maintenance of refining and petrochemical plant. It will cover damage mechanisms such as: under insulation corrosion, hydrogen attack, creep, temper embrittlement etc. It will further cover issues like materials used, welding procedures, heat treatment and weld defects. The course will then lead on to life assessment issues, the effect of operation and operating environment. Specific topics will include: coke drums, pipework, heaters, reformer tubes, reactors etc.

International Seminar

New Materials (P91, P92, P122, T23) Used in High Temperature Plant

Venue: London Dates: 20–21 June 2007

This two-day Seminar will address the issues such as:

- Use and abuse of P91;
- Welding and weld consumables;
- Understanding and use of T23, T24;
- Creep and creep-fatigue interaction;
- Base material and welding heat treatments;
- Experience of various utilities and plant failures worldwide;
- Life assessment issues

The seminar will be preceded by a *two-day training course* on the understanding and use of P91/ T91 and its steam oxidation, welding and life assessment issues.

Training Course

Integrity of Heat Recovery Steam Generating (HRSG) Equipment

Venue: Central London

This two-day course will cover a host of issues such as HRSG design, cyclic operation, materials and welding, water treatment, corrosion and failure mechanisms, inspection, monitoring, maintenance and life assessment. *Four modules* and a *Workshop* will be delivered by experts with plant experience. The Workshop is designed to give the participants first hand experience of HRSG component life assessment. Topics covered include: Design issues (horizontal versus vertical gas flow designs), improved start-up techniques, causes of localized high stresses in pressure parts during start-ups and shutdowns and the influence of combustion turbine exhaust gas characteristics, accessibility and inspection methods, component monitoring, data storage and analysis for integrity evaluation and life assessment, available component monitoring procedures and their suitability for HRSGs and maintenance issues.

TECHNOLOGY DEVELOPMENT

To provide effective plant services and best value to our customers ETD are continuously involved in the development of leading edge technologies in collaboration with international industry and experts. Examples are:

Projects **HIDA** (High-temperature Defect Assessment) and **HIDA Applicability** were technology development projects involving large European industry (e.g. Framatome, EDF) and research organisations (e.g. Imperial College, French Atomic Energy) and led by ETD since 1998.



The two projects were supported by the European Commission. HIDA involved developing and validating a draft European **crack assessment procedure**. Its successor 'HIDA Applicability' involved developing procedures for **sensitivity and probabilistic assessment** of creep and fatigue crack growth data. As a part of this project a Knowledge Based System (KBS) has been produced which automates many of the functions of component crack assessment.

Project **INTEGRITY** is an international industry and European Commission supported project which deals with the behaviour and assessment of repaired welds made using conventional, cold-weld and novel **weld repair techniques** for use in high temperature plant.

In this project ETD developed *procedures for life assessment of both new and repaired welds*, validated by FE Analysis and with tests on large and complex components.



HRSG Maintenance Guidelines

This is an international industry sponsored project aimed at: a) reviewing the best Heat Recovery Steam Generator inspection, maintenance, monitoring etc. practices, and, b) discussing materials (including new high strength steels such as P91), welding and repair issues.

The project covered both plant experience from around the world and research findings to recommend to the plant operator the best practices, procedures and methodologies to monitor, inspect and maintain plant. It is aimed at helping HRSG operators to reduce costs and increase profitability. For further information on the project and how to participate please write to:

enquiries@etd1.co.uk

Find us on the
WEB at
www.etd1.co.uk

OMMI

OMMI (Power Plant: Operation, Maintenance and Materials Issues) is published by ETD three times a year in April, August, and December.



OMMI is a *refereed* internet journal which provides a wealth of information by world's leading experts in the area. It can be visited at:

www.ommi.co.uk

Examples of Clients or Project Partners

Kyushu Electric

Siemens

Mitsubishi

ESKOM

Electricite de France

INNEOS/BP

Skoda

Innogy

Doosan Babcock

**PPSB
Malaysia**

Mannesmann F I

ExxonMobil

ENEL



**ONTARIO POWER
GENERATION**

**SABIC
Saudi Arabia**

AES Lalpir, Pakistan

Sumitomo

Alstom Power

**CLP
Hong Kong**

**ANSTO
Australia**

V&M Tubes

