



Development of a Procedure and Software for Remaining Life Assessment of Power Plant Boiler and Steam Turbine Components

Acronym: **ETD Lifting Procedure**



Proposal Brief

ETD Project No: 1100-gsp-prop08

Note: This is the brief of a new innovative Proposal developed for a Group Sponsored Project (GSP). Organisations seriously interested in the project are requested to write to ETD for the full proposal and the costs involved. (In the ETD model of GSP each sponsor pays a fraction of the total cost of the project while benefiting from the full project results and deliverables. It is not obligatory on the sponsors to contribute to the project work).

INTRODUCTION

The principal **objective** of this Group Sponsored Project (GSP) is to prepare a Procedure which provides step by step guidelines for the integrity and Remaining Life Assessment (RLA) of power plant boiler and steam turbine components. ETD staff have been: a) conducting RLA on their clients' plant worldwide and have accumulated a vast amount of experience in this area; b) involved in research and development activities in RLA of high temperature plant where many of these projects have been/are being conducted in collaboration with leading international organisations and world experts from Europe, North America, Japan and elsewhere; and, c) are regularly conducting training courses and seminars on life assessment and extension of high temperature plant (both power and petrochemical) in the UK and in many other countries such as USA, Hong Kong, Portugal, Canada, Malaysia, Dubai, Abu Dhabi, Pakistan, Germany and France. In addition, ETD have conducted tailor made courses on plant life assessment for large utilities from countries such as Hong Kong and Korea. This work involved RLA of industrial components made not only from the traditional alloys (2.25Cr1Mo, 1CrMoV, etc.) used for high temperature plant, but also those involving relatively newer materials (such as P91, P92, P23 etc).

In the course of conducting the training courses ETD had the opportunity to organise a great deal of literature and experience in RLA in a form that could be more easily understood and applied by power plant engineers for a systematic integrity and life assessment of their plant. However, this organisation was in the form of presentations. It was also realised during the course of ETD work that most of the information needed for RLA work is scattered between various sources of published papers, books, conference

proceedings, codes and standards (such as RTD, VGB, BS, ASME etc). Similarly the sources of material property data are also varied and a good life assessor needs to know which values to use under what circumstances. All of this is even more true for the relatively newer materials for higher temperature plant where the long term material strength values have recently been re-evaluated and new sources of data have evolved. Also, a number of publications have recently appeared dealing with the lifing issues unique to the components made from these steels. In this context ETD's own work on the lifing of, for example, P91 components is quite unique. Thus there is a strong need for putting this information together in the form of a Procedure and Guidelines for RLA of high temperature plant.

ETD have, apart from the above experience, already prepared procedures and/or software for, for example, power plant maintenance, defect/crack assessment, HRSG maintenance and repair, and plant monitoring etc. With this background, ETD are in an excellent position to prepare this new procedure and guidelines both in a paper and software format.

The concept of the preparation of a software to encompass this procedure came as a result of requests from some of the trainees in the ETD conducted RLA courses where it was considered that such a software could make the use of the ETD Procedure much more easy both by the novice and the expert plant and service providing engineers and life assessors. Such software could, for example, contain an atlas of micrographs for various materials used in power plant boilers and turbines making it easy for the life assessors to compare their plant material condition with various degrees of deterioration observed in the standard micrographs. New information appears regularly from new R&D work and plant experience and a software format for such a Procedure will make it easy to update and include this new information on regular basis. A software could also show the demonstration of on-site RLA work making it much more easy for the integrity and life assessors to understand the practical aspects of life assessment.

New NDE inspection and monitoring tools have recently appeared on the market such as portable Scanning Force Microscopy, Ultrasonic Phased Array Probes, Long-range Guided-Wave, Laser Guided Portable Hardness Tester, Wireless Sensors, High Temperature UT Probes etc. Furthermore, new techniques of long term data extrapolation for design and life assessment of high temperature components (such as Wilshire Equations), creep data quality check procedures developed by the European Creep Collaborative Committee etc. have recently appeared on the horizon. Many other developments such as probabilistic life assessment, risk based procedures etc. are also now contributing to the more realistic (and less conservative) life estimates of high temperature plant. The Heat Recovery Steam Generators (HRSGs) in the now ubiquitous CCGTs also need to be considered in any new lifing procedure. The ETD Lifing Procedure will thus aim to incorporate many of these aspects and new developments.

DEVELOPMENT OF THE 'ETD LIFING PROCEDURE'

Details of the procedure development available on request.

DELIVERABLES AND COSTS

ETD will start working on the project on receipt of the order from at least five project sponsors/ clients.

The *deliverables* will be:

- a) A Procedure containing guidelines on a systematic approach to power plant boiler and turbine life assessment. This procedure will be based on the various available codes and standards both for design and life assessment. It will further draw upon the experience of the actual plant life assessment by engineers and the more recent research findings and the new materials data.
- b) A software will be prepared for the ease of the use of the Procedure both by novice and expert plant engineers and service providers.

The benefit of a Group Sponsored Project (GSP) is that as the cost of the project is divided between a number of sponsors, each sponsor pays a fraction of the total cost while receiving the full product. The cost for participation in the project/ sponsorship will be sent to those seriously interested in participation. Though not mandatory, the sponsors will be encouraged to contribute any useful plant experience or research based information and data that they may be able to provide to enrich the final product for all participants.

TIMESCALE

It is planned that a deterministic draft Procedure and the prototype version of the software will be completed in a one year timescale. However, a further six month period will be needed to: a) include the probabilistic capabilities to the procedure; incorporate the sponsors' comments and refine the Procedure; and c) produce a commercial 'tried and tested' version of the software. The total project duration will thus be 18 months although sponsors will be expected to be able to use the procedure after one the year timescale. A Mid-Term Report will be produced and provided to the sponsors after eight months.

The project start date will depend on the securing of five sponsors and it is envisaged that for a project of this significance and need it should be possible to secure enough sponsors and start the project by Spring 2008 or possibly earlier.
