



# European Technology Development Ltd

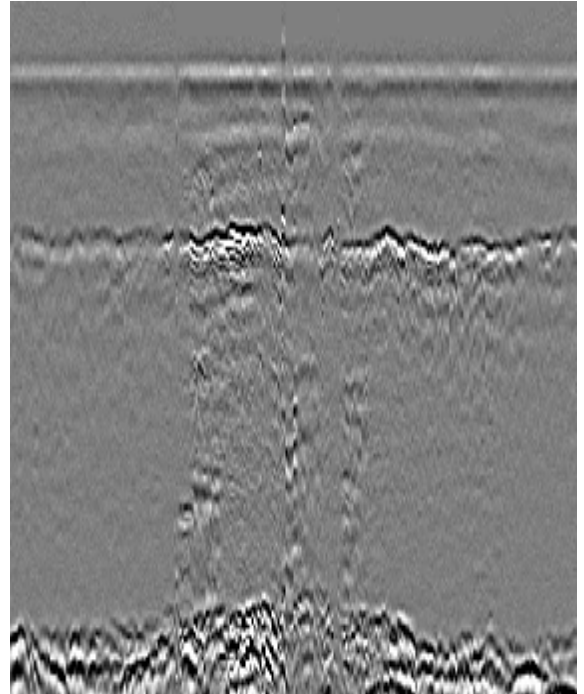
Working for Power, Petrochemical, and Process Plant Industries

## Plant Fitness-For-Service (FFS) Assessment

European Technology Development offers expert services in the evaluation of petrochemical/ process/ refining and power plant covering a range of potential damage mechanisms (and their interaction) including but not limited to:

- Corrosion
- Creep
- Hydrogen Damage
- Fatigue
- Embrittlement

ETD assesses the fitness for service of plant under operating conditions which can give advanced warning of in-service failures. This can help the plant operators in reducing cost by avoiding costly unplanned outages and at the same time minimise excessive maintenance or premature inspection. ETD has experience of using standardised approaches such as those outlined in API 579. Furthermore, ETD has initiated and led the development of some of the European approaches to fitness-for-service in addition to its extensive experience in life assessment.



*ToFD image showing indication*

Typically process units are designed for 100,000 hours service. Plants operators are faced with an increasing array of ageing plant and equipment, in many cases close to or even beyond the original design life. Furthermore, damage accumulates with service time. This damage accumulation may be accelerated by a number of factors, for instance, poor design/fabrication or possible changes in the service environment. Therefore, once the plant reaches its design life or if the operating conditions change, a fitness for service review needs to be implemented.

ETD implements this assessment in a staged way as follows:

### **Step 1: Preliminary Fitness-For-Service Assessment and Inspection**

A *Level I fitness* for service assessment is normally implemented before the on-site assessment of the work commences. Due to the lack of recorded data normally available for the type of unit being

studied, the calculations are usually based on design information and any other information that can be derived from historic inspection and operating data. The results of these calculations are combined with ETD's experience of assessing plant to enable us to undertake a preliminary and conservative fitness-for-service review. Normally, the assessment is performed using API 579. However, and for the areas that are not covered by this procedure (e.g. high temperature crack initiation and growth), ETD applies European procedures some of which ETD was involved in developing. This assessment allows ETD to identify those components that are fit for further service and those that require further evaluation. Based on the results of the Level I fitness, an inspection strategy for the key components in the plant is then drawn up.

*Note: The inspection data collected is initially reviewed on site and then sent back to ETD offices where further assessment can be undertaken.*

## Step 2: Implementation of the Inspection Programme

The limited and focused inspection programme on critical components defined in Step 1 is then **implemented** either by the client or by a team supervised by an ETD engineer. Normally, an inspection technique with automated data collection will be recommended to ensure that a permanent record of the findings is available.

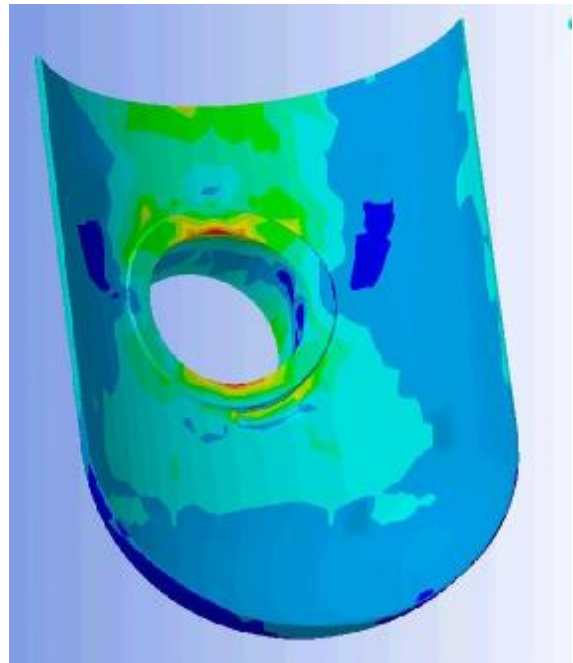
## Step 3: Final Fitness-For-Service Assessment

Following completion of the on-site assessment the data will be compiled and a fitness-for-service evaluation will be implemented.

Depending on the site findings, this may involve all three Levels (i.e. Levels I to III) of FFS assessment, with **Level III fitness** being the most detailed calculational phase involving finite element modelling to refine the stress analysis of the component investigated.

This assessment may include evaluation of a wide range of damage mechanisms including (but not limited to):

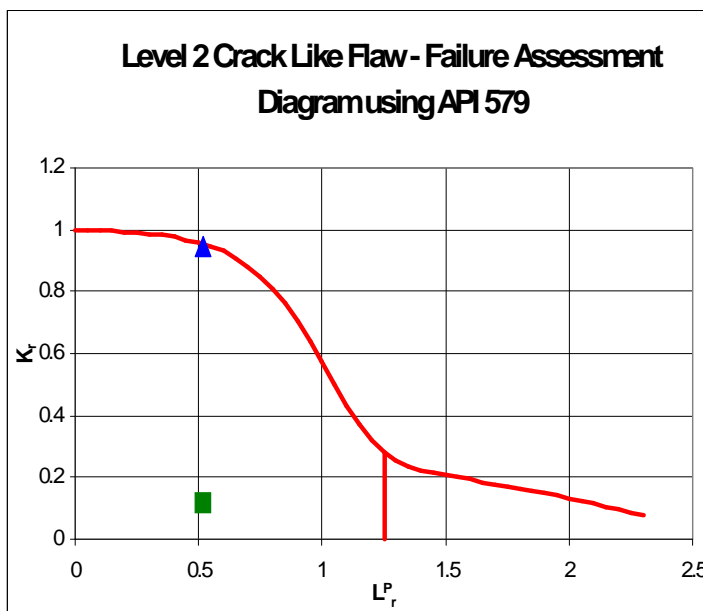
- **Loss in wall thickness**
- **Defect assessment**
- **Pitting corrosion**
- **Creep damage**
- **Crack growth assessment**
- **Temper embrittlement**
- **Hydrogen damage**



*Finite element stress analysis of a nozzle*

Based on the conclusions of the FFS assessment, the plant components suitability for further service may be drawn. Where the condition of the plant does not allow for continued operation, ETD can provide appropriate advice/recommendations on safe operation, repair or replacement strategies.

*(With regards to repair, ETD has extensive experience in repair welding, including cold repair welds i.e. without PWHT. These welds require careful excavation and preparation and rely upon control of heat input to obtain a high level of tempering in the HAZ of the repair weld).*



*Failure assessment Diagram showing the acceptability of a defect*

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