

# Defect Analysis

## OVERVIEW

The AESL pipeline condition assessment process requires the external inspection of the pipeline and its environment at selected locations. Scans using AESL's patented Magnetic Flux Leakage (MFL) Tool allow the presence and geometry of defects in the pipe wall to be established at these locations.

The presence of such defects results in stress fluctuations in the surrounding area of the pipe wall and thus, increases the risk of failure.

AESL have developed their own software based on equations from BS 7910:2005, Guide to Methods for Assessing the Acceptability of Flaws in Metallic Structures. This software allows predictions to be made of the geometry of a critical defect that may initiate failure.



Photograph 1 – Photograph of external defect

## SOFTWARE INPUTS

A detailed stress analysis of the pipe section is completed using a finite element software package to allow the maximum hoop and bending stresses under various loading regimes to be calculated, which are used as inputs for the software.

Material properties including fracture toughness, yield stress and ultimate tensile stress (UTS) are then used as parameters that will determine the critical

defect depth that may cause structural failure of the pipe and hence, the acceptability of any defects identified in the inspection.

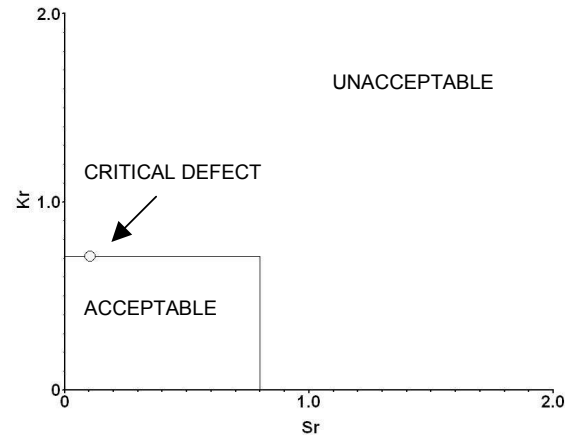


Figure 1 – Failure Assessment Diagram (FAD)

Assessment of acceptability of a defect is made by means of a failure assessment diagram (FAD) based on the principals of fracture mechanics – see Figure 1. The vertical axis is a ratio of the applied conditions to the conditions required to cause brittle fracture; the horizontal axis is the ratio of the applied load to that required to cause plastic collapse. An assessment line, seen as a box in the lower left corner of the plot area in Figure 1 above, is also included in the FAD. Calculations for a flaw provide the coordinates for an assessment point. Assessment points that fall within the assessment lines are considered acceptable. The corresponding assessment point for a critical defect sits on the assessment line.

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