

ENGINEERING CRITICAL ASSESSMENTS

This course is an introduction to the methods used to determine the size of pipe imperfections that may be large enough to lead to fracture. Key concepts discussed: fracture toughness (CTOD and J), elastic/plastic fracture mechanics, failure assessment diagram (FAD), strain-based design.

Expected Results: Improved understanding of the technology available to determine allowable/tolerable imperfection size.

The course will cover:

- Background
 - Discussion on flaws in pipelines and the methodology used to estimate the critical loads that flaws propagate
- Basic concepts
 - Material toughness and crack driving force will be reviewed
 - Current methods for stress-based design to establish critical conditions
 - Crack-tip opening displacement, Failure Assessment Diagrams
 - Discussion on tearing instability
- Recent developments
 - Developments in strain-based design, introduced primarily for pipelines crossing unstable terrain or subjected to plastic strain during pipe laying, will be discussed.

Methodology of ECA: Standard techniques to perform ECA based on fracture mechanics principles are available in a number of pipeline standards, including CSA Z662 (the Canadian pipeline code). For stress-based design, ECA may be done using the Crack Opening Displacement COD design curve (CSA) or Failure Assessment Diagram FAD.

Current Developments: To support strain-based design, a toughness testing method using a single-edge-notched tension-loaded SE(T) (or SENT) specimen is nearing standardization

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