PROCEEDINGS PAPER

INCEFA-SCALE (INCREASING SAFETY IN NPPS BY COVERING GAPS IN ENVIRONMENTAL FATIGUE ASSESSMENT – FOCUSING ON GAPS BETWEEN LABORATORY DATA AND COMPONENT-SCALE)

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Abstract:

INCEFA-SCALE is a five-year project supported by the European Commission HORIZON 2020 programme. INCEFA-SCALE kicked off in October 2020 and is the successor to the INCEFA-PLUS programme that ran from 2015 to 2020. The objective is to continue working towards advancing the ability to predict lifetimes of Nuclear Plant components when subjected to Environmental Assisted Fatigue (EAF) loading.
There are no publicly available failure events that are clearly attributable to EAF which contrasts with the difficulty in obtaining an acceptable result from a fatigue assessment. It is internationally recognised that a contributor to this discrepancy is the transferability of data from laboratory-scale tests to real nuclear components. This is the main knowledge gap addressed by INCEFA-SCALE. The project strategy is (1) the development of mechanistic understanding developed through detailed examination of test specimens and data mining from large fatigue datasets, and (2) testing and analysis focussed on loading history and geometrical effects like notches and specimen design. The project has created tools to survey the fatigue data within Joint Research Council's database as well as the International Fatigue Database and feed screened data into analyses. The uniaxial testing work package (WP) focussed on studying the effect of variable amplitude loading, environment, surface condition, and specimen geometry on the fatigue life of stainless-steel specimens. The features testing WP is focussed on notch testing and studying complex loading from specimen geometries. Materials characterisation is investigating the effect of the test conditions on fracture surfaces and combining that analysis with a range of material properties and test data to contribute towards an improved mechanistic understanding of EAF. The analysis WP is actively working on scientific and engineering models to inform predictions of specimen life and develop approaches to account for the conditions studied in EAF assessments. Finally, the project will deliver guidance on the use of laboratory-scale data for component-scale applications.
This paper will outline progress from the previous four years of the project. Specific details relating to the testing, materials characterisation, and analysis work packages will be presented in additional papers and presentations during the INCEFA-SCALE session.

Keywords: environmentally assisted fatigue, pressurized water reactor, stainless steel

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