

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 Environmentally Assisted Fatigue (EAF) loading.

Nuclear Plant operators have generally observed that the number of failure events attributable to EAF are fewer than predicted by current assessment methodologies. 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 will be (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 aspects and features of component-scale cyclic loading. The project has created tools to survey the fatigue data within JRC's database and feed screened data into analyses. In parallel, a testing programme has been specified and is underway. The testing programme is focussed on studying the effect of variable amplitude loading, environment, surface condition, and specimen geometry on the fatigue life of stainless-steel specimens. A materials characterisation work package is investigating the effect of the test conditions on fracture surfaces and combining that analysis with a range of materials properties and test data to contribute towards an improved mechanistic understanding of EAF. An analysis work package 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 first two 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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