

INCEFA+

INcreasing safety in NPPs by Covering gaps in Environmental Fatigue Assessment

OBJECTIVES

US NRC and ASME guidance for environmentally-assisted fatigue (EAF) assessment can result in calculated high fatigue usage factors that are inconsistent with NPP experience. So the overall aim of the project is to develop new or modified guidelines for assessment of EAF damage susceptibility for NPP components. The project has the following specific objectives:

- ☐ Identify the most significant differences between conditions producing EAF damage in NPPs and laboratory tests.
- ☐ Test representative materials to improve understanding of the sensitivity to these differences on fatigue life in PWR primary environment.
- ☐ Develop a new or modified procedure for assessing fatigue degradation in reactor coolant under plant conditions to avoid excessive conservatism inherent in current US NRC guidelines and draft ASME Code Cases.

DESCRIPTION OF WORK

The project is divided in two main parts. The first is focused on the characterization of a limited selection of typical austenitic stainless steel alloys employed in NPPs, testing for the effects of mean stress/strain, hold time periods and material surface finish on fatigue endurance. Sensitivities to these three parameters will be mainly tested in LWR environments. Tests in air for all types of specimen are restricted to only those necessary to cross reference the LWR results with the data already available for fatigue endurance in air and forming the majority of data used to underpin existing guidance (NUREG/CR-6909). The three experimental parameters were selected as common priorities by the proposed collaborators based on an in-kind project through which a description of the current state-of-the-art for this technical area was developed. The second part of this project involves the development of a modified or new procedure for estimating the fatigue degradation of the materials based on the experimental results of the first part of the project. This methodology is supposed to take better account of the effects of mean stress/strain, hold time and surface finish. This will enable better management of nuclear components, making possible the LTO of NPPs under safer conditions.

MAIN DELIVERABLES OR RESULTS

The main deliverable of the project is a new or modified fatigue analysis procedure. It will incorporate the new data generated within the project:

- ☐ New parameters that have effects on the fatigue degradation,
- ☐ New and more representative fatigue curves (S-N),
- ☐ New or tentative modification to the expressions for environmental factor assessment,
- ☐ Guideline for fatigue assessment of components of NPP

Besides a new/revised fatigue analysis procedure the project will also establish a new fatigue data format standard. For that purpose the workshop FATEDA has been started in the framework of the "Committee European de Normalisation" (CEN). More information on FATEDA can be found under <https://www.cen.eu/work/areas/ICT/eBusiness/Pages/WS-FATEDA.aspx>.

FUNDING & BUDGET

Project co-funded by the European Commission under the Horizon 2020 Euratom Programme

Total budget: EUR 6.1 Mio

EC funding: EUR 2.55 Mio

DURATION

1 July 2015 – 30 June 2020

5 years

WEB

<http://incefaplus.unican.es>

PARTNERS & CONTACTS

AMEC Foster Wheeler / AREVA / CIEMAT / CEA / EON / INESCO / JRC / EDF / UJV / PSI / SCK-CEN / VTT / Univ. Cantabria / LEI / Rolls-Royce / IRSN

Technical Project Leader:

Kevin Mottershead (AMEC Foster Wheeler)

kevin.mottershead@amecfw.com