

**INTERNATIONAL FATIGUE DATABASE IN SUPPORT OF NUCLEAR ENERGY SAFETY**

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**Proceedings of the ASME 2025 Pressure Vessels & Piping Conference (PVP2025)**

July 20-25, 2025, Montreal, Quebec, Canada

Paper No.: **PVP2025-155276**; 6 pages

DOI: 10.1115/PVP2025-155276

Published Online: October, 2025 (*expected*)

URL: <https://asmedigitalcollection.asme.org/>

Abstract:

Management of fatigue is a prerequisite for the safe long-term operation of nuclear power plants, more so given that nuclear energy offers a viable carbon-neutral alternative to fossil-fuel plants. The corresponding body of experimental fatigue data that has accumulated is of significant inherent intellectual and commercial value. This body of data is however fragmented and with limited accessibility, which is an obstacle to analysis, critical evaluation of codified methods and the development of robust models in support of long-term operation. Consequently, engineers and researchers are forced to work with data collections that are potentially incomplete and/or inconsistent, thereby hindering cooperation in a critical subject in which major progress is typically beyond any single organisation. Consider for example the fatigue analyses required during the design of nuclear power plants in Section III of the ASME BPVC, which historically has provided air design curves and a method for evaluating the acceptability of the applied design loads. Section III also requires a general consideration of environmental effects but provides no requirements for assessing their impact on fatigue. Whereas environmental effects were not considered in the US during the original licensing of the plants to 40 years, their effects do need to be addressed for operation beyond 40 years, which has led to the development of several ASME code cases and methods to account for environmental effects on fatigue in light-water reactor environments. In this context, the  $F_{en}$  concept has been adopted within the ASME Code as a method to address environmental effects on fatigue life. The  $F_{en}$  concept was based on a data collection that resulted from a cooperation between several organisations, as summarised in NUREG/CR-6909. However, this data has historically only been available in part, thereby hindering evaluations of the method and comparison with other methods under development, such as the Margin Curve and proposals from the Japanese Design Fatigue Curve Subcommittee. To address these shortcomings, a prior PVP publication gave attention to an EDF/NRC proposal for a high-cycle fatigue database. In the scope of the Horizon Europe INCEFA-SCALE project on increasing safety in NPPs by covering gaps in environmental fatigue assessment, focusing on gaps between laboratory data and component scale, the EDF/NRC proposal has evolved to deliver the International Fatigue Database in Support of Nuclear Energy Safety. This paper reports on the status and ambition of the database.

Keywords: fatigue, data, long-term operation



This project has received funding from the Euratom Research & Training programme 2019-2020 under grant agreement N° 945300