

ACES

Towards Improved Assessment of Safety Performance for LTO of Nuclear Civil Engineering Structures

OBJECTIVES

- Critical review of ageing management practice across EU Nuclear Power Plants (NPPs) focusing on deterioration and ageing mechanisms of reinforced concrete, related to structural integrity assessment and ageing management criteria required for effective decision-making regarding LTO.
- Integrated probabilistic assessment methods to account for uncertainties and improve inspection capabilities.
- Innovative quantitative methodologies to transfer laboratory material properties to assess the structural integrity of large concrete components.
- Advanced simulation tools based on nonlinear finite element method, lattice-based models, Fast Fourier Transform (FFT) based simulation, and combined empirical and mathematical material models, reflecting the latest findings related to combined effect of various loading (e.g. environment, radiation) and chemical/electrochemical reactions (e.g. corrosion, internal swelling reactions) on concrete performance, i.e., the creation and evolution of deterioration areas in concrete structures.
- Improved understanding of internal swelling reactions and temperature/moisture effects on the delayed strains of containment buildings; Improved prediction of the evolution of moisture, strain and stress of prestressed concrete containment buildings.
- Improved assessment of the effects of prolonged irradiation of the concrete biological shield using a holistic approach combining operating conditions, materials degradation and structural significance.
- Improved understanding of corrosion phenomena focusing on embedded liners, predicting the occurrence of corrosion and developing an innovative inspection tool for early detection of corrosion.

EXPECTED IMPACTS

ACES will have a significant impact on the safety of operating nuclear power plants by demonstrating and revealing inherent safety margins being introduced by the conservative approaches used during design and being dictated by codes and standards used through the lifetime of the plant. The outcome of ACES will support the long-term operation of nuclear power plants, by using more realistic approaches for the integrity assessment of reinforced concrete SCC's and provide evidence by large scale tests.

HIGHLIGHTS

ACES will improve the understanding of ageing/deterioration of concrete, and will demonstrate and quantify inherent safety margins introduced by the conservative approaches used during design and defined by codes and standards employed throughout the life of the plant. The outcomes from ACES will therefore support the LTO of NPPs. This will be achieved by using more advanced and realistic scientific methods to assess the integrity of NPP concrete infrastructure. The project will provide evidence to support the methods by carrying out various tests, including large scale tests based on replicated scenarios of NPPs.

PARTNERS

VTT / ENGIE LABORELEC / CVR / CTU / CEA / EDF / IRSN / ENERGORISK / SCKCEN / ORNL / ZAG

DURATION & BUDGET

09/2020 – 08/2024 - 4 years
5.45 Million Euros

CONTACTS

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EVENTS

The first project meeting will take place in Helsinki in March 2021.

