Seismic Assessment Methodology for the Beyond Design Basis Post-Fukushima Requirements for Systems and Components

Case study

Following the incident at the Fukushima Dai-ichi nuclear power plant in 2011, EASL was engaged by the client to provide support and expertise for enhancements to several systems and components that required improved resilience to the beyond design basis seismic event at the Hinkley Point C new build nuclear plant. EASL were requested by the client to produce a deliverable to document the seismic assessment methodology for these systems and components with the aim of ensuring that Hinkley Point C would not be at similar risk.

Background and methodology

Following the incident at the Fukushima Dai-ichi nuclear power plant in 2011, other nuclear power plants including Hinkley Point C (HPC) were re-examined to apply the lessons learnt from this incident.

As regards the HPC nuclear plant auxiliary facilities, EASL was engaged to provide support and expertise for enhancements to several systems and components that required improved resilience to the beyond design basis (BDB) seismic event.

The comprehensive approach that EASL undertook for the BDB seismic assessment for the enhanced resilience requirements was based on a conservative deterministic failure method which allowed the claim of high confidence of low probability of failure (HCLPF). The methodology included substantiation and/or qualification by experience, data, testing and analysis.

EASL provided guidance for identifying the appropriate load combinations, ground response spectrum, damping values, the structural capacity and other

important seismic analysis parameters.

EASL also proposed seismic ruggedness databases in literature derived from seismic testing of equipment as well as methods to use them and/or repeat them where necessary.

The qualification included the requirement for stability and/or integrity as well as functional or operability requirements for cases defined by the client.

The seismic qualification of components and systems was obtained via three methods: reconciliation against the design basis event (DBE) assessment, analysis and assessment and/or shaker table tests. The former acknowledged that a previous DBE assessment would have been performed.

In order to minimise the additional work needed for the BDB assessment, the EASL deliverable provided guidance on how to modify the existing DBE methodology for the cases that would allow it.

The Outcome

The substantiation/qualification satisfied the seismic safety classification based on common standards such as the RCC-M for mechanical and RCC-E for electrical equipment.

The calculations of seismic responses satisfied seismic analysis guidelines in ASCE 4-98 and equivalent guidance.

Overall, the approach that the EASL team took provided the insurance that the HPC team required that a similar incident would not be repeated on their plant.

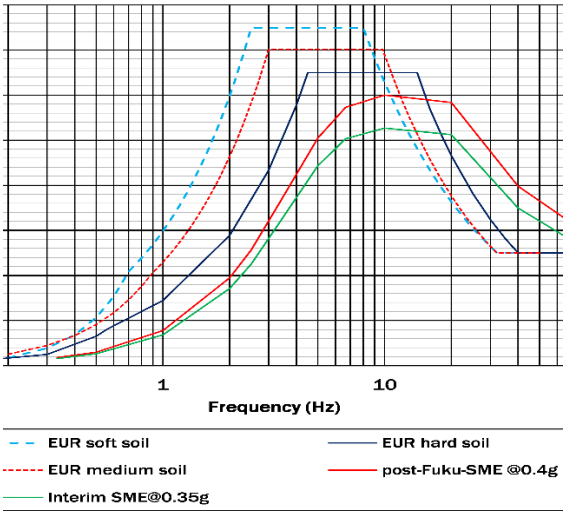

Figure 1 EUR DBEs at 0.25g and post-Fukushima SME at 0.4g (@40Hz) with 84% confidence

Other applications

EASL have extensive capability in seismic assessment. EASL always work with clients to identify cost effective solutions to operational challenges.

If you would like to discuss how EASL can help your business please get in touch.

engineering analysis services ltd.
2 Edward Court, George Richards Way, Altrincham, WA14 5GL
0161 923 0070 www.easl-stress.co.uk