



Case study

Graphite Core Safety Case

BACKGROUND

The UK has a fleet of ageing Advanced Gas-cooled Reactor power stations. There is an ongoing regulatory requirement to demonstrate that the reactors are safe to continue operating.

As part of this requirement, our client needed to demonstrate that the behaviour of the graphite core is understood, and that its future behaviour can be predicted – with good confidence – to a time beyond the operating period of the safety case.

One of the key ageing mechanisms which must be addressed within the safety case is the issue of graphite weight loss. Weight loss from the core occurs as a result of radiolytic oxidation in a carbon dioxide atmosphere.

Graphite weight loss can potentially affect the core's ability to maintain the channel geometry, which is needed to allow unimpeded movement of fuel and control rods. It can also affect the core's ability to provide neutron moderation to control the nuclear fission process.

THE CHALLENGE

Understanding the behaviour of graphite is a relatively new technical field, and little experimental data is currently available. Predicting its behaviour is even more challenging as it can vary considerably, both within and between bricks.

OUR SOLUTION

Frazer-Nash undertook a comprehensive assessment of the reactor graphite cores at both Hinkley Point B and Hunterston B, and provided the following evidence to support our client's safety case:

- ▶ Identification of the safe limits on graphite weight loss, considering all operating and safety issues affected by weight loss. These limits related to a variety of control volumes including keys, bricks and the whole core.
- ▶ Prediction of the average weight loss for all control volumes.
- ▶ Development of probabilistic methods of predicting weight loss using response surfaces.
- ▶ Use of measurement data from reactor core sampling campaigns to improve confidence in the weight loss predictions.

Through the development of a long term relationship with our client, we have been able to build a team of highly experienced engineers across a broad range of disciplines to address the complex engineering problems associated with predicting graphite material behaviour. This team has provided research based solutions within tight safety case timescales.

Our assessment provided the evidence to demonstrate that the behaviour of the cores can be predicted up to clearly identified weight loss limits. This enabled our client to submit a robust safety case to the Regulator.

Client

EDF Energy Nuclear Generation

Business need

Safety Case to allow continued operation of nuclear power stations.

Why Frazer-Nash?

Our wide range of engineering skills and ability to provide innovative solutions.

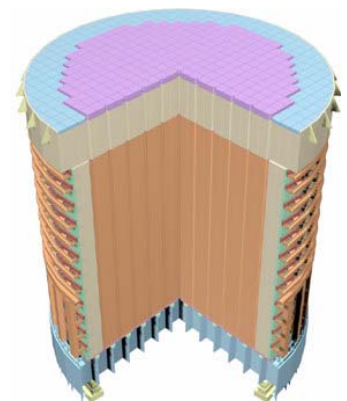


Figure 1: Cross section of a reactor graphite core

For more information, please contact nuclearpg@fnc.co.uk or visit www.fnc.co.uk