

Case study

Lifetime assessment of reactor vessels

THE CHALLENGE

The reprocessing of spent nuclear fuel involves a number of high-temperature processes which can damage the reactor pressure vessels as a result of creep rupture. Our client's rigorous inspection review highlighted possible defects in the vessel welds (*generated either from manufacture or operational mechanisms*), and they asked Frazer-Nash to analyse the vessels to ensure they could be used safely, up to and beyond their design life.

OUR SOLUTION

After comprehensively reviewing the operational history of the vessels to identify regions most at risk, we were able to get a clearer understanding of the operational loadings which are placed upon the vessels. We then used heat-transfer and finite element (FE) analysis to determine the operational stress states which are likely to cause creep.

By combining the results of the FE modelling with the conclusions of the operational history review, we were able to carry out detailed and accurate creep-fatigue assessments in accordance with guidance from the BS7910 safety standard. We were able to reassure our client that their pressure vessels were safe from the danger of creep rupture – within any conceivable lifespan.

BENEFITS

These assessments were able to accurately predict the vessel locations most vulnerable from creep damage, allowing future inspections to focus on key areas. The tangible benefits of our findings were:

- ▶ A reduction in operational downtime
- ▶ A reduction in operator dose uptake
- ▶ A reduction in operational costs
- ▶ Confidence in safe operations
- ▶ Compliance with British Safety Standards

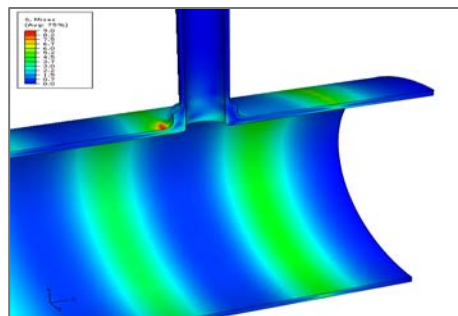


Figure 1: Thermal stress around a vessel nozzle



Client
Sellafield Ltd

Business need
Assess the integrity of high temperature reactor vessels

Why Frazer-Nash?
Our expertise in the nuclear sector has grown for many years allowing us to become one of the most renowned consultancies in the nuclear sector.

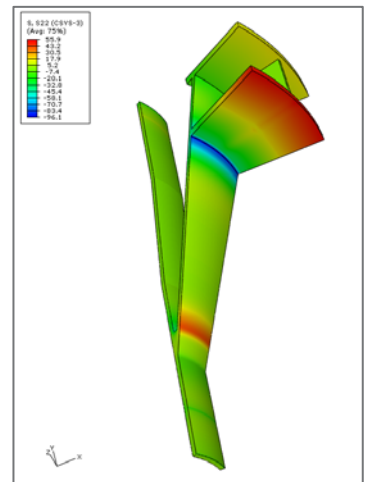


Figure 2: Thermal stress in a section of the reactor vessel

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