Case study

Lifetime Assessment of Reactor Vessels

ISSUE

The reprocessing of spent nuclear fuel involves a number of high-temperature processes in high integrity reactor pressure vessels.

As part of a rigorous inspection review, it was considered that there could be the potential for damage to the vessels resulting from creep. Frazer Nash were asked to perform analyses to ensure that the vessels could be operated safely up to and beyond their design life.

ANALYSIS

A comprehensive review was undertaken of the operational history of the vessels, to allow judgements to be made of the regions of the vessels most at risk, and to allow a greater understanding of the operational loadings. Heat-transfer and finite element analyses of the vessels were undertaken to determine the operational stress states.

By combining the results of the finite element modelling with the conclusions of the operating review, creep-fatigue assessments could be carried out, in accordance with guidance from BS7910.

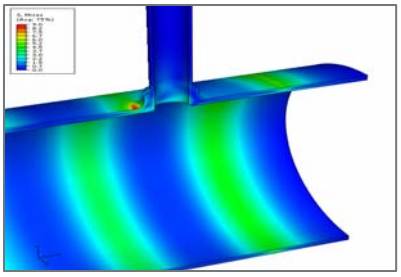
BENEFITS

Our assessments proved that the vessels were safe from the danger of creep rupture within any conceivable lifespan. Despite the assumption of defects in the vessel welds (from either manufacture or generated through operational mechanisms) our assessment indicated a very satisfactory margin on the required operational lifetime.

These assessments provide confidence to support an extension of the inspection intervals of the vessels, this in turn provides:

- Reduction in operational downtime
- Reduction in operator dose uptake
- Reduction in operational costs
- Confidence in safe operations.

The analyses have also provided our client with a prediction of the vessel locations most at risk from creep damage, allowing future inspections to focus on specific areas.



Thermal stress around a vessel nozzle

Client

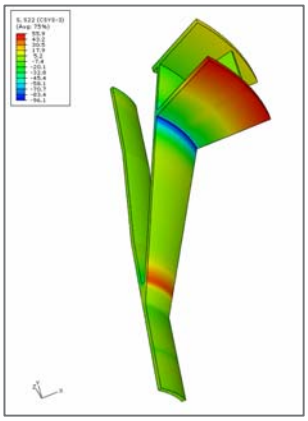
Sellafield Ltd

Business need

Assess the integrity of high temperature reactor vessels

Why Frazer-Nash?

Frazer-Nash expertise in the nuclear sector has grown for many years to become one the most renowned consultancy's in the nuclear sector.



Thermal stress in a section of the reactor vessel

For more information please contact **Ken Neal** on **01925 404000** or email **k.neal@fnc.co.uk**