

Design and analysis report AHWR End shield-calandria assembly

The End shields of AHWR form part of the calandria vault enclosure provide shielding, integral support to calandria vessel along with its internals and support and locate assemblies like coolant channel assemblies, in-core neutron detectors, ion chambers etc. The Calandria is a vertical cylindrical vessel fully filled with heavy water, which acts as moderator as well as radial, top and bottom reflector.

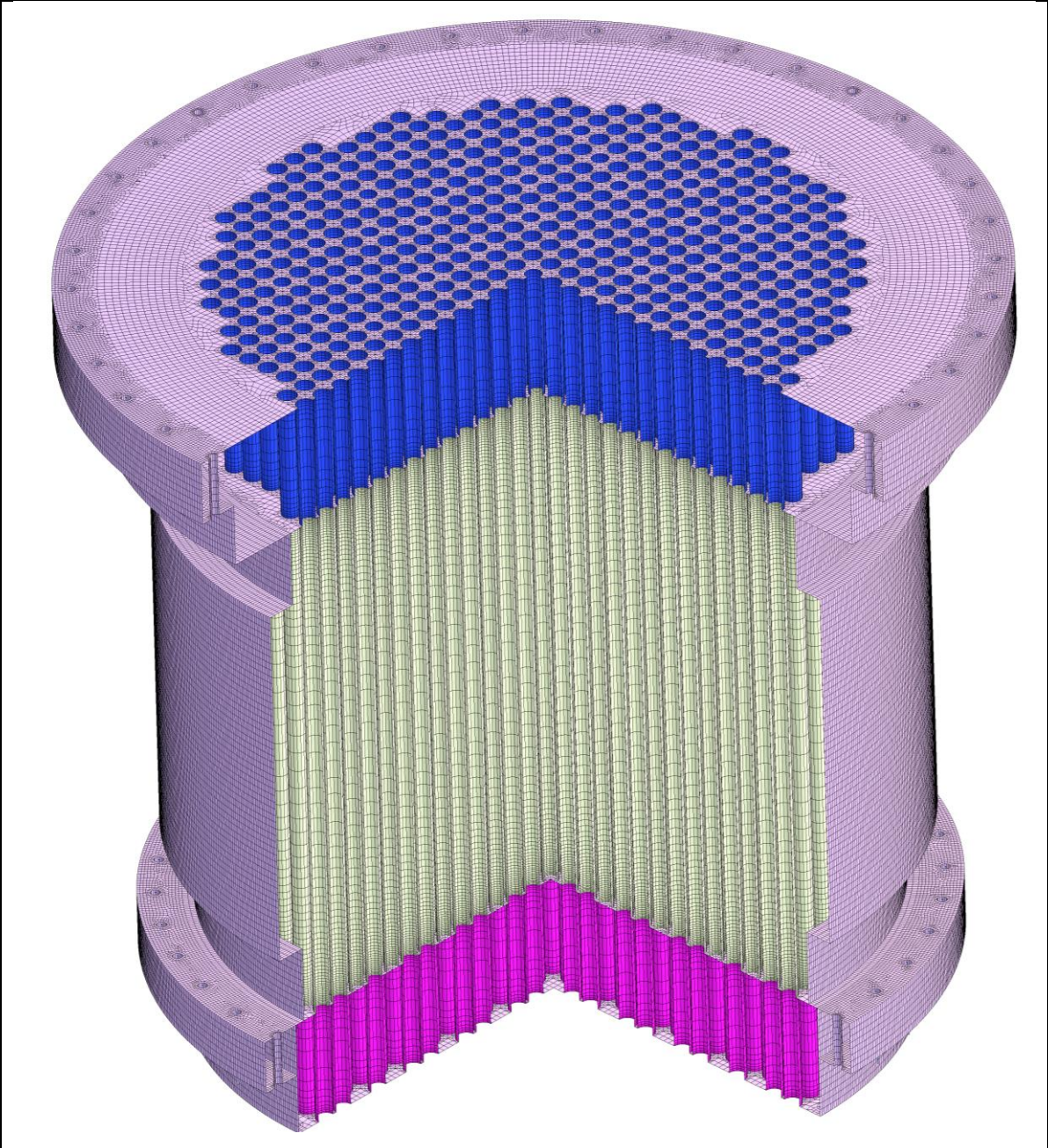
This also includes the weight of the 452 coolant channels, 37 shutdown rods and 24 control rods. The End shields and calandria are safety class – 1 components and seismic category is Category S2 (SSE&OBE). These are designed and qualified as per ASME Boiler and Pressure Vessel Code, Section-III, Sub-Section NB.

The end shields and calandria are critical component as they are carry and transfer complete weight of the reactor block. A detailed finite element analysis of the integrated assembly of end shields, calandria tubes and calandria was carried out for various design and service loading conditions including SSE and OBE seismic loads.

Major highlights of the analysis are as follows:

1. The 3D Finite element model of the complete assembly including modelling of tubes and tubesheets was used for accurate stress evaluation.
2. The loads on the assembly as per the actual sequence of the construction. This loading sequence followed ensures realistic stresses on components. As in the actual case the Calandria Tubes are installed in the sagged geometry of end shield
3. The total weight of the AHWR Calandria End Shield Assembly is 1652T with support reactions exceeding 2000T for some load cases.
4. The effect of creep and growth of the calandria tubes due to irradiation along with thermal expansion has been considered and the end of life stresses in the calandria, end shield and calandria tubes have been evaluated.
5. The modal analysis and seismic analysis by response spectrum methodology has been carried out for both OBE and SSE.
6. The stresses in the end shield and calandria under loads due to rigging have been evaluated.
7. A total 14 load cases of Design and Service level loads were analysed.

A P0 level Design and Analysis report for this work is prepared.



FEM Model of the Calandria End Shield Assembly (cutview)