Steel Restraint for Boiler Recovery

Case study

Competing with 15 other contract partners, in 2007 EASL were selected by the client following an extensive consultation and optioneering exercise, to provide comprehensive design and assessment work to address significant operational concerns at the Hartlepool and Heysham 1 nuclear power stations. The benefit to the client was to secure the future operation, generating capacity and associated revenue from both stations.

Above other competition

EASL's historic knowledge of these stations and expertise provided a clear and practical long term solution for the client.

At these stations the boiler units are of a podded design, suspended from a pre-stressed concrete boiler closure unit (BCU). The BCUs support the weight of the boilers and form part of the pressure boundary.

In October 2007 inspections of the BCU wire windings revealed evidence of broken and slipped wires within one BCU at Hartlepool. This finding was outside the safety case and led to the decision to shut down all four reactors sharing the same design.

The extent of condition across all BCUs (there are eight BCUs per reactor) was determined following subsequent radiographic inspections, which confirmed that all four reactors were affected by corrosion of the BCU pre-stressing wires.
A revised safety case was therefore required to justify the return to service of the four shutdown reactors.

This led to a standstill in power production for the client, with over 2 GW of generating capacity for the national grid out of commission, all four reactors at both stations were shutdown whilst still incurring running costs.

ONCE SELECTED FOR THE JOB, IN THE IMPLEMENTATION PHASE EASL WAS RESPONSIBLE FOR:

- Conceptual design;
- Detailed design;
- Analysis and assessment;
- Support to safety case production;
- Full scale prototype testing;
- Support to manufacture;
- Support to installation;
- Support to commissioning; and
- On-going in-service monitoring.

The project

A project for BCU recovery was established and the elements of a safety case for return to service defined. A key part of the strategy for return to service was the implementation of a number of significant modifications intended to reduce the dependence on the wire winding pre-stressing system, including fitting an external steel restraint (ESR) to each BCU.

This would provide additional vertical restraint to the top of the BCU in the unlikely event of extensive cracking of the concrete and thereby prevent any breach in the reactor pressure boundary due to loss of pre-stress in the BCU.

The ESR was designed to be fitted to the upper surface of the BCU and constrained by the BCU primary studs. The function of the structure is to resist the loading from normal operating and fault conditions associated with the BCU assuming no residual pre-stress and that the existing BCU is cracked and, hence, the up-thrust pressure loading acting on the BCU is transferred to the new restraint structure.

All four reactors are now back in service and the EASL ESRs are helping to ensure continued safe operation of the power stations subject to a programme of on-going monitoring and inspection.

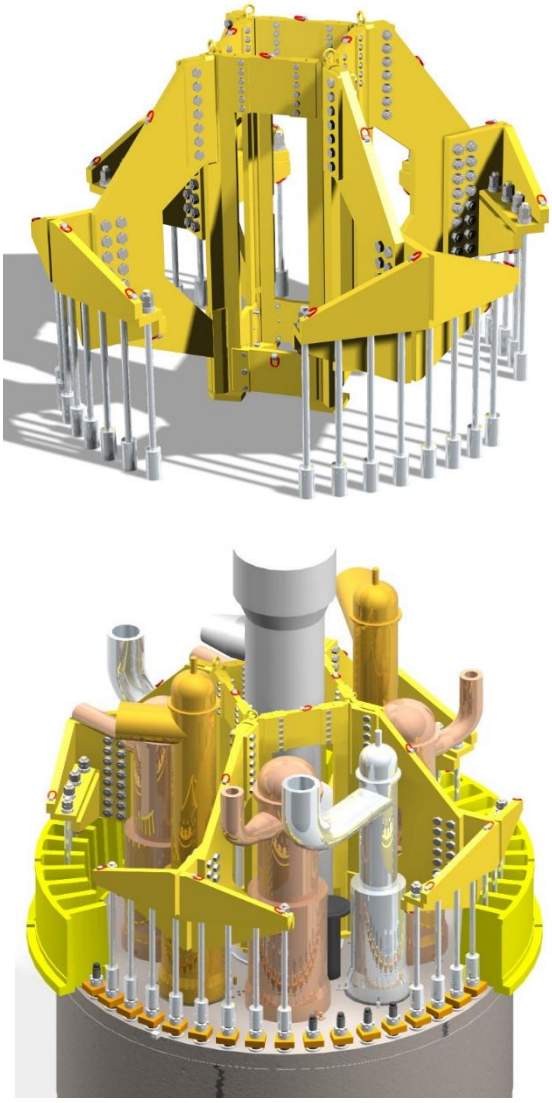

Figure 1 The ESR and primary studs (top); the ESR fitted to a BCU (bottom)

Other applications

The complex technical challenges on this task were met within the tight timescales specified and the client's plant was successfully returned to surface.

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.

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