DESIGN REVIEW AND HAZOP STUDIES FOR STABLE SALT REACTOR

Jon Brooking, Atkins Ltd, Bristol, United Kingdom

Atkins has been assisting Moltex Energy in carrying out a review of their Stable Salt Reactor (SSR) (formerly the Simple Molten Salt Reactor (SMSR)), which they believe has many benefits over other nuclear reactor systems. Their current design is for a 2.5GW thermal output reactor, supplying a superheated steam turbine that could provide an electrical output of 1GW.

Our first task was to carry out an assessment of the SSR concept against relevant UK Regulatory Requirements, using data and information that was provided by Moltex Energy. Moltex Energy updated their design using the output from this review.

The next activity was to carry out a Hazard and Operability (HAZOP) review to identify issues that may not have been apparent in the original design and the UK Regulatory Requirements assessment. For the HAZOP, we brought together a Process Engineer, Fuel Route and Mechanical Handling Specialist, Safety Case Engineer, Reactor Chemist, Decommissioning and Waste Management Specialist. The HAZOP review gave rise to the generation of a list of key Structures, Systems and Components (SSCs) that would be necessary in a fully designed reactor system, which were discussed and described in a report. This report provided the scope and assumptions that were used as the basis for the costing estimate, using expertise provided in-house by Faithful and Gould.

Also post the HAZOP meeting there were a few more aspects identified, including the need for cooling of the concrete surround to the metal, reactor tanks, and the need for control, or rather shutdown, rods, which were confirmed in separate discussions that Moltex Energy had with other experts.

Using the scope and assumptions report we were able to generate a rough-order-of-magnitude (ROM) cost estimate. The costing activity generated ROM costs for some, but not all, areas on a nuclear power station, which included:-

**Nuclear Island**
- Reactor building, which houses the reactor and its key support systems, including Fuel Assembly Shuffling Machine, Polar Crane, equipment maintenance areas, Off-gas Management equipment, electrical plant rooms, Heating, Ventilation and Air Conditioning (HVAC) plant rooms, etc.
- Emergency Diesel Generator Buildings.
- Control Building.
- Interim Fuel Building.
- Interim Waste Building.

**Conventional Island**
- Turbine Hall.

Our paper will:-
- Discuss the processes used in more detail.
- Identify how these processes increased the knowledge and design concepts to ascertain the SSCs in more detail.
- Discuss the costing approach and the use of a three-point capital cost estimate, modelled using Monte Carlo simulation, to provide a cost/uncertainty distribution profile.
- Discussion on how Atkins can assist with the Indian reactor programme using a similar approach detailed above.