

عنوان مقاله:

Three-Dimensional Thermocline Dynamics in Thermal Storage Tanks

محل انتشار:

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خلاصه مقاله:

In this work, a series of three-dimensional unsteady numerical simulations are performed to study the stability and interface dynamics of a thermocline-based lab-scale single tank Thermal Energy Storage system (TES). The stability of thermocline is analysed by introducing relatively cold fluid for a short period at the inlet of the TES. Numerical simulations are performed for three inlet flow disturbances (weak, medium and strong) and three stratification levels (sharp, moderate and large). The fluid injected at the inlet rolls-up and interacts with the thermocline which causes spatio-temporal disruption of the stable stratification inside the TES. It was found that the three-dimensional simulations bear some resemblance to the two-dimensional case but also show crucial differences. The propagation of the injected cold fluid and the subsequent interaction with the thermocline are analysed. A wide gamut of flow structures is identified inside the TES depending on the degree of stratification and level of disturbance. Finally, the oscillatory nature of interface and associated mixing mechanism are addressed. The simulation indicates that the oscillations at the interface are through the successive generation of countersign vorticity which retards/suppresses the propagation of the vortex ring. In the case of large interface, internal waves are generated by the periodic array of .vortices which generates a standing wave pattern near the Brunt-Va isa fa 'frequency

كلمات كليدى:

Stratified storage system, Vorticity dynamics, Baroclinicity, Buoyancy frequency

لینک ثابت مقاله در پایگاه سیویلیکا:



