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NUMERICAL INVESTIGATION OF BOND OVERTOPPING UNDER STORAGE TANK FAILURE EVENTS

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Abstract. Containment enclosure bonds are typically designed to contain only 110% of the maximum stored tank capacity inside the bond. Moreover, the mechanical design of bonds normally considers only the hydrostatic pressure efforts. However, after several accidents and experimental tests it was well established that under some tank failure cases the stored liquid can easily overtops the bond containment because of the energy of the released wave. This paper is concerned with computational fluid dynamics simulations (CFD) conducted to investigate the efficiency of different bond designs and breakwaters under several tank failure modes. Simulations were carried out using Volume of Fluid (VOF) to resolve scale laboratory models, for which there are some experimental data to assess the solver. The use of breakwaters showed to be a suitable way to reduce overtopping, avoiding the use of high bond walls or to move the bond away from the tank. Moreover, the incorporation of breakwaters induced significant extra mechanical efforts over the containment.