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Mixing in Long Cylinder by a Stratified Jet: Laboratory Modeling and Theory[1] C. NATH, S.I. VOROPAYEV, H.J.S. FERNANDO, University of Notre Dame — The evolution of buoyant turbulent jets released into a low aspect ratio (width/height) cavity filled with a homogeneous fluid was investigated experimentally. The motivation was to understand mixing process in U.S. Strategic Petroleum Reserves (SPR), where crude oil is stored in salt caverns of aspect ratio approximately 0.1. During maintenance, degassed oil is introduced as a jet from the top of the caverns while denser gas-laden crude oil is pumped out from the bottom. The focus was on mixing, formation and development of density layer as well as the time for replenishing oil in the container to an acceptable level of vapor pressure (gas concentration). Basing on the results of experiments a theoretical model was advanced which permits to calculate the vertical density distributions in cavern as a function of time and other external parameters. Satisfactory agreement between theory and measurements was demonstrated. The results obtained could be extrapolated to SPR flow mixing situations and help to improve the efficiency of expensive oil cavern refilling.

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