Erosion of a stratified layer by a diffuse buoyant jet: controlled experimental parametric variations

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Abstract

Nuclear engineering research groups are interested in the interaction between a rising jet and a stratified layer located above in order to better understand hydrogen accumulation and dispersion mechanisms in a nuclear reactor containment.

In real containment configurations, obstacles such as pipes, components as pumps or tanks and walls can dissipate the initial momentum of the gas release. Consequently, the upward flow pattern can be considered as "diffuse" and buoyant, but not as a jet or a pure plume. This challenging issue was part of a project called HYMERES, which was launched and conducted in the OECD/NEA framework. Dedicated experiments were performed to study the interaction between a diffuse buoyant jet and a two-layer stratification. The HM1 test series were conducted in the large-scale MISTRA facility. For these tests, an erosive flow pattern came from a horizontal hot air jet impinging on a vertical cylinder. A CFD benchmark was organized based on these experimental results. A second series was conducted by CEA to study the effect of initial and boundary conditions by controlled parametric variations i.e. change of air injection flowrate and strength of the two-layer stratification. These new results, which are very interesting to challenge a CFD model tuned against HM1-1 tests, will be presented.

Keywords: Containment, Atmosphere mixing, Hydrogen distribution