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Modeling the Initial Conditions of Two-Phase Jet Flow through an Orifice After Depressurization

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Abstract

Phase Doppler Anemometry (PDA) measurements of velocity and droplet size distribution have recently been reported for two-phase flashing jets.
Two-phase flashing jets are predicted to occur when chemicals stored at elevated pressures and temperature are accidentally released to the atmosphere.
The principle determinant of the initial dilution rate of a two-phase jet released to the atmosphere is its velocity after depressurization to atmospheric pressure. The maximum stable droplet size can be related to the initial velocity by a Weber number criteria.
It has been shown that the initial velocity can be an important determinant of the flammable extent of a release as well as the maximum possible rainout of liquid based on predicted droplet sizes. This paper summarizes present models for flashing single-component, two-phase flow through orifices. Model predictions are compared with available data including rainout data from flashing two-phase flow experiments designed to maximize the measured rainout. Model predictions are also compared with measured velocity and droplet distribution parameters from flashing two-phase flow experiments ma downstream jet.
Methods for inferring the initial (depressurized) jet velocity and maximum droplet size are discussed.