The Importance of Multiphase and Multi-Component Modeling in Consequence and Risk Analysis

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ABSTRACT

The ability to accurately predict the consequences of a hazardous fluid release depends on: the knowledge of the modeler, the quality of the model that is used, and the quality of the input parameters. A difficult problem in consequence modeling is the prediction of post-release multiphase behavior, especially when a multi-component mixture is involved. Releases from gas/oil wells often fit this description. For example, a wellstream will produce a light crude oil and a gas stream when flashed into a separator. The liquid/gas split and compositions depend on the initial wellstream temperature and pressure and the separator pressure. When such a wellstream is accidentally released to the atmosphere, the gas, aerosol, and liquid fractions rarely match the separations in the separator, or the expectations of the modeler. Since the wellstream has a wide range of hydrocarbon components, the need to accurately predict the multicomponent behavior becomes more important.

Over the years, modelers have used several “rules of thumb” to provide the source term input parameters for modeling multiphase/multicomponent releases and subsequent dispersion. These modeling assumptions can lead to hazard predictions that are very different from reality. The biggest problem with rules of thumb is their inability to account for thermodynamics; thus, they cannot approximate the phase splits and composition changes that do occur. The aim of this paper is to improve the knowledge of the modeler, by providing some insight into the selection of the proper input parameters for multiphase releases of multicomponent fluids. The application of a multiphase release model with multicomponent thermodynamics to a wellstream release is used to illustrate the importance of good modeling techniques.