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Experimental Study of the Spill and Vaporization of a Volatile Liquid DOUGLAS BOHL, NSWC Indian Head, GREGORY JACKSON, University of Maryland — Assessment of potential hazards during shipment of flammable liquids (both cryogenic and otherwise) requires an understanding of the coupling between large-scale spill dynamics and formation of a flammable vapor cloud. The scale of such events prohibits detailed experiments and thus hazard will require improved spill/vaporization models validated against smaller-scale experiments. Subscale wind-tunnel experiments were undertaken to characterize pool and vapor cloud formation from an acetone spill issuing from a large rectangular flow obstruction. The spill event was largely governed by the temperature of the spill surface in relation to the boiling point of the spilled liquid though the free-stream velocity also impacted the spreading of the spill. Planar Laser-Induced Fluorescence (PLIF) was used to measure acetone vapor concentrations during the pool spreading and vaporization downstream of the obstruction. Because of obstruction induced recirculation region, regions of vapor within the flammability limits were localized near the flow obstruction. The highly unsteady vapor cloud was observed to grow well past the downstream edge of the measurement domain. With decreasing wind speeds, both the mass of vapor within the flammability limits and the total event time increased significantly.

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