Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Plumes and Fountains in a Cross-Wind BRUCE SUTHERLAND, ALEXENDRA ANDERSON-FREY, JOSEPH ANSONG, University of Alberta —
Sour gas flares attempt to burn off hydrogen sulfide (H2S), a poisonous gas that can kill at concentrations higher than 100PPM. Because in some areas of the Rocky Mountain foothills the concentration of the gas before burning can be has high as 20%, flaring must be extremely efficient to prevent disaster. Recent studies have shown that cross-winds can reduce the efficiency to 30% meaning the concentration of unburned gas at the source can be as high as 60000PPM. Engineers rely on atmospheric dispersion to reduce the concentration to tolerable levels before the plume extends to the ground. To predict the dispersion of the gas close to the source, the US Environmental Protection Agency uses a numerical model, AERMOD, that heuristically adapts plume theory to account for the effects of winds and atmospheric inversions. They do not account for the fact that H2S is heavier than air at room temperature and so would tend to pool in valleys after cooling. We have performed laboratory experiments to examine the dynamics of positively and negatively buoyant plumes in uniform and stratified environments with a uniform background flow. The results are then compared with the predictions of the AERMOD model.

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Date submitted: 20 Jul 2010 Electronic form version 1.4