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Measurement of Turbulent Fluxes of Swirling Flow in a Scaled Up Multi Inlet Vortex Reactor MICHAEL OLSEN, EMMANUAL HITIMANA, JAMES HILL, RODNEY FOX, Iowa State University — The multi-inlet vortex reactor (MIVR) has been developed for use in the FlashNanoprecipitation (FNP) process. The MIVR has four identical square inlets connected to a central cylindrical mixing chamber with one common outlet creating a highly turbulent swirling flow dominated by a strong vortex in the center. Efficient FNP requires rapid mixing within the MIVR. To investigate the mixing, instantaneous velocity and concentration fields were acquired using simultaneous stereoscopic particle image velocimetry and planar laser-induced fluorescence. The simultaneous velocity and concentration data were used to determine turbulent fluxes and spatial cross-correlations of velocity and concentration fluctuations. The measurements were performed for four inlet flow Reynolds numbers (3250, 4875, 6500, and 8125) and at three measurement planes within the reactor. A correlation between turbulent fluxes and vortex strength was found. For all Reynolds numbers, turbulent fluxes are maximum in the vortex dominated central region of the reactor and decay away from the vortex. Increasing Reynolds number increased turbulent fluxes and subsequently enhanced mixing. The mixing performance was confirmed by determining coefficients of concentration variance within the reactor.

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