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This talk concerns the Taylor-Aris dispersion of a dilute solute concentration immersed in a highly heterogeneous fluid flow having possibly sharp interfaces (discontinuities) in the diffusion coefficient. The focus is two-fold: (i) Calculation of the longitudinal effective dispersion coefficient, and (ii) determination of the probability laws governing the (stochastic) motion of the underlying solute particles. Essentially complete solutions are obtained for both problems. (Received August 26, 2005)