J.E. Till, A.S. Rood, C.D. Garzon, and R.H. Lagdon. 2014. “Comparison of the MACCS2 Atmospheric Transport Model with Lagrangian Puff Models as Applied to Deterministic and Probabilistic Safety Analysis.” Health Physics, 107, 213-230.

ABSTRACT: The suitability of a new facility in terms of potential impacts from routine and accidental releases is typically evaluated using conservative models and assumptions to assure dose standards are not exceeded. However, overly conservative dose estimates that exceed target doses can result in unnecessary and costly facility design changes. This paper examines one such case involving the U.S. Department of Energy’s pretreatment facility of the Waste Treatment and Immobilization Plant (WTP). The MELCOR Accident Consequence Code System Version 2 (MACCS2) was run using conservative parameter values in prescribed guidance to demonstrate that the dose from a postulated airborne release would not exceed the guideline dose of 0.25 Sv. External review of default model parameters identified the deposition velocity of 1.0 cm s^{-1} as being non-conservative. The deposition velocity calculated using resistance models was in the range of 0.1 to 0.3 cm s^{-1}. A value of 0.1 cm s^{-1} would result in the dose guideline being exceeded. To test the overall conservatism of the MACCS2 transport model, the 95th percentile hourly average dispersion factor based on one year of meteorological data was compared to dispersion factors generated from two state-of-the-art Lagrangian puff models. The 95th percentile dispersion factor from MACCS2 was a factor of 3 to 6 higher compared to those of the Lagrangian puff models at a distance of 9.3 km and a deposition velocity of 0.1 cm s^{-1}. Thus, the inherent conservatism in MACCS2 more than compensated for the high deposition velocity used in the assessment. Applications of models like MACCS2 with a conservative set of parameters are essentially screening calculations, and failure to meet dose criteria should not trigger facility design changes but prompt a more in-depth analysis using probabilistic methods with a defined margin of safety in the target dose. A sample application of the probabilistic approach is provided.