

MODELING HOTMIX ASPHALT POLLUTANT FORMATION AND COLLECTION USING COUPLED DEM AND CFD METHODS

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Tighter emissions regulations mean that extra care be taken to mitigate smoke formation and propagation in hotmix asphalt equipment. In a typical HMA plant, the asphalt mix is stored in insulated silos. Petroleum light ends contained in the asphalt mix are released when the asphalt mix is transferred from silo storage units into trucks for transport to the jobsite. As the vaporized light ends cool in the ambient air smoke is formed (Figure 1). Designing an effective smoke abatement system is a considerable challenge. Field installation and testing is expensive so computer simulation presents a more cost effective design tool provided the computational models can accurately represent the dynamic nature of the smoke propagation.



Figure 1. Silo to truck transfer showing smoke formation

Because the primary driver for the smoke flow is the air displaced by the falling asphalt mix, continuum methods fail to capture the dynamics of smoke formation. Improvements were made to the coupling of commercial CFD and DEM codes to reduce computation times. The work presented makes use of the commercial CFD and DEM codes, ANSYS FLUENT

and EDEM from DEM Solutions coupled using an open source coupling developed by collaboration between ANSYS and Astec. The coupled DEM and CFD method presented in the paper was shown to accurately simulate the displacement driven flow and smoke formation. The Eulerian multiphase model is used with a non-reacting species transport model to account for the air/smoke mixture in the fluid phase. Transient, coupled simulations were run for a range of conditions and pollutant extraction designs to determine the best design and operating conditions for optimal efficiency (Figure 2). With the information obtained from the simulations a prototype collector is expected to be built and tested in Q2 2014.

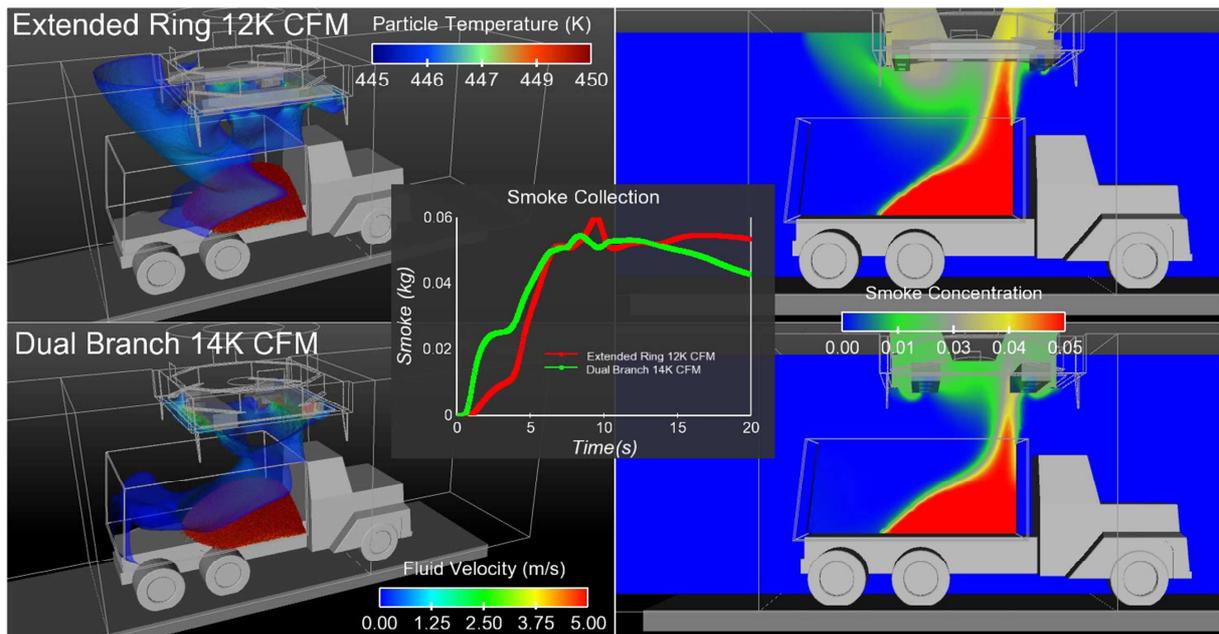


Figure 2. Coupled CFD and DEM results showing pollutant collection of two collector designs