HPAC Hazard Areas for Variations of Bacillus Anthracis Releases

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Dispersion of bacillus anthracis (BA) spores released into the atmosphere can present hazards to people over potentially wide areas. As for any aerosolized particulate, the hazard area produced by transport and dispersion in a given meteorology of BA spores and spore clusters depends heavily on the physical properties of the particle, the size, density, and numbers of spores per cluster. These properties depend directly on spore shapes, volumes, densities, amount of hydration, packing fraction (fraction of cluster volumes occupied by spores), and density of non-spore material resident in clusters. Available laboratory data on these properties for BA show them to vary significantly depending on strain, preparation, and mechanism of release. These variations result in large differences in the hazard areas predicted by transport and dispersion codes such as the Joint Effects Model/Hazard Prediction and Assessment Capability (JEM/HPAC) for a given release. The work presented here quantifies the dependence of dispersed hazards on the known properties of pathogenic strains of BA spores and clusters and relates that dependence to standard dispersion code inputs such as viable and non-viable mass fraction, particulate density and organisms per microgram. The variations in JEM/HPAC estimates of hazard areas for a given release due to the known variations of these particulate properties are shown to be hundreds of percent compared to the standard default calculation. Analysis of these results provides definitive algorithms to specify inputs to JEM/HPAC directly related to release properties so that uncertainties in hazard estimates are reduced by orders of magnitude, greatly improving the operational utility of these estimates for hazard assessment. (Material assigned a clearance of CLEARED on 26 Sep 2019)