LOCALIZING CHEMICAL AND BIOLOGICAL THREAT DETECTION

High-purity Vapor Generation Of Semi-volatile Chemical Agents For Wearable Sensor Validation

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The development and validation of wearable sensors relies heavily on the applicability of the conditions and threats used to test them. Chemical agent vapors are typically generated using an in-house diffusion tube apparatus that has been well characterized and can produce vapor streams crossing multiple orders of magnitude in concentration. The diffusion setup can produce chemical vapors at mathematically predicted concentrations based on diffusion tube lengths, bores, number of diffusion tubes, temperature, and dilution flows. These calculations are continually improved via a machine learning approach. Diffusion systems work best with volatile materials and allow the analyst to dial in most concentrations from single ppb to ppth. Issues arise when working with low volatile materials that require significant temperature increases to produce vapors. While vapor
generation does increase, as predicted, so does the production of degradation products. This causes the generated vapor to have multiple unintended analytes present, most with very similar structures, potentially convoluting library building and sensor validation tests. MRIGlobal developed improved methods for the dissemination of low vapor pressure materials without the need for elevated temperatures. Testing was conducted on 11 low vapor pressure highly toxic materials, including the following chemical warfare agents: A232, A234, VX, VLX, CVX, RVX, VE, VS, VG, VM, and Q. This dissemination generated reproducible vapor streams at higher than expected concentrations, with very low degradation products and impurities. Vapor profiles demonstrate the improved vapor stream cleanliness and enable the creation of high quality chemical libraries and on-board reference signatures.