Instantaneous Detection of Particles Liberated by Open Detonation Treatments

The technique BioAerosol Mass Spectrometry has previously been proven effective in the detection of biological agents deliberately aerosolized in the laboratory. The technique functions by determining the aerodynamic diameter and collecting a laser ionization mass spectrum of many individual environmental particles in real-time. Real-time data analysis allows this information to be reported to the user in an immediately useful form. It was believed that this could be applied to assess the environmental impact of particles released from open detonation treatments by tracking their arrival at locations far from the sites of the detonations themselves.

A BioAerosol Mass Spectrometer (BAMS) was deployed to an experimental open detonation facility at Lawrence Livermore National Laboratory's Site 300. Fine tungsten particles ingrained in the explosives were readily observed upon detonation, proving the concept of detecting particles liberated by an open detonation treatment. Particles apparently containing traces of explosives were also observed in the seconds following the blast. Both types of particles were distinct from background particles observed at the site in the minutes before the detonations, and were readily identified.

Further experiments were carried out on pure charges at a firing chamber at the laboratory. It was found that varying the laser desorption energy had a profound impact on the mass spectral signatures of the particles. Under low desorption energy conditions, molecular ions of the explosives present in the detonated charge were observed. The combination of the detection of particles liberated by an open detonation treatment in real time with the determination of optimal laser desorption/ionization conditions in the laboratory proves the concept of the use of BAMS as a means to track plumes from open detonation treatments.