TECH NOTE 4.0

Aerosol Detection and Identification with MX908

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Deadly aerosol hazards can be dispersed from actions as simple as handling an unknown white powder, to as complex as detonating a chemical munition on the battlefield. The Aero is designed to provide a unique capability to detect and identify aerosolized threat materials.

The advantage of the MX908 with Aero

With the Aero attachment equipped, the MX908® draws in air from the ambient environment and analyzes it in real-time for vapor-phase threats, just like a conventional measurement with the Vapor Module. Aerosolized solids and liquids are also collected onto a screen within the module in parallel to the real-time vapor monitoring. After a short period of continuous vapor measurement and aerosol collection, an array of high efficiency heaters flash-heat any trapped particulate matter for analysis by the miniaturized mass spectrometer. In this sense, the Aero's operating principle for aerosol analysis is similar to swab analysis via thermal desorption using the Trace Module, but without requiring any direct user intervention.

Aerosols encountered in the field are dynamic and span a wide range of particle sizes and particle size distributions, both of which affect the duration an aerosol plume persists in the air. The exact distribution of particles encountered at the time of detection is influenced by the phase of the aerosol material, the way in which the aerosols were generated, and the means by which they were released into the environment. Over time, the particle size distribution within the aerosol plume becomes enriched with smaller diameter particles as heavier particles settle out and/or decrease in size due to evaporation.

The response of the MX908 is driven by the amount of sample mass introduced to the system. As such, the Aero has been designed to provide >80% trapping efficiency for particles larger than 2.5 microns in diameter, maximizing the amount of particulate mass collected while addressing the challenging detection scenario a dynamic aerosol plume presents.

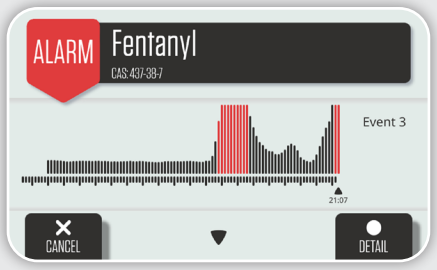
Testing the Aero for performance

The Aero was tested under controlled laboratory conditions on both solid and liquid aerosols encompassing benign and serious chemical threats. The aerosol desorption conditions were optimized to ensure threat materials with high boiling points, such as fentanyl and its derivatives, were adequately detected without sacrificing sensitivity against lower boiling point liquids, such as VX. The Aero was also challenged against liquid aerosols of the Novichok (A-series) class of nerve agents across a range of concentrations and ambient humidity. The system consistently alarmed at concentrations at or below 0.1 mg/m^3 as shown in Table 1 on the next page.

The Aero was also tested in the field under operational

The Aero attached to the MX908.

CW Hunter Aerosol Mode allows users to detect and identify aerosolized chemical warfare agents and pharmaceutical based agents.



On screen alarm alerts the user to the presence of aerosolized fentanyl.

Aerosolized Chemical	Test Concentration Range (mg/m^3)	Exposures/ Alarms
A-234	0.1 – 0.4	38/38
A-232	<0.1 mg/m^3	12/12
VX	<0.1 mg/m^3	15/15

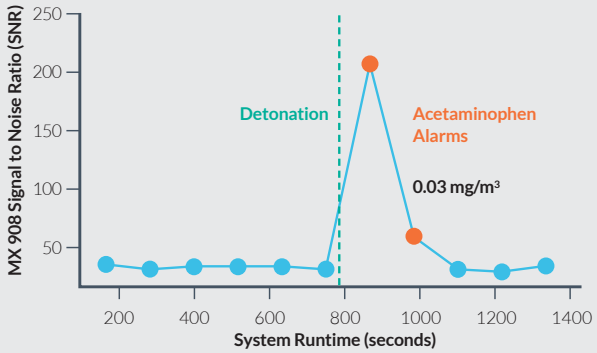
Table 1. Summary of Chemical Agent Aerosol Testing Results.

conditions in a dusty (high clutter), desert environment. Small explosive charges were coupled to powdered acetaminophen and detonated, releasing a plume of aerosolized material into the immediate environment. Aero modules were installed on several MX908 devices which were positioned 40-50 feet downwind from the point of detonation to serve as "sentinels" — alerting the user to the presence of potentially hazardous material in the plume. Each MX908 was co-located with a particle counter that enabled real-time ground truth measurements of the aerosol plume particle size distribution and concentration. The MX908 systems performed well, detecting 5/6 releases at aerosol concentrations below 0.1 mg/m^3 and as low as 0.01 mg/m^3. Importantly, all aerosol exposures across the concentration range — whether in the laboratory or in the field — cleared out within a few minutes, providing the user minimal down-time after exposure.

The MX908 with Aero fills a critical gap in aerosol threat detection, demonstrating detection capability across a broad range of aerosolized threats: solid and liquid chemical warfare agents, including fourth generation agents (Novichoks) and fentanyl analogs. Its seamless integration onto the MX908 enables the end-user to quickly access and rapidly deploy this capability at the point-of-need.

MX908 outfitted with an Aero and co-located with a particle counter to provide ground truth measurements of the aerosol plume.

Overview image of an acetaminophen aerosol plume formed from a detonation.



MX908 system response before, during, and after detecting the acetaminophen aerosol plume. Plume concentration detected at the MX908 was 0.03 mg/m^3.

Learn more about MX908 at **908devices.com/MX908**

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