

White paper

Reliably detecting anthrax spores at the frontline without destroying the sample

White powder incidents represent a constant and costly problem for a wide range of agencies and organizations. Those on the frontlines at these incidents – the first responders – need tools that can help make rapid, reliable and accurate threat assessments and informed decisions. Key among these tools is a handheld device that can reliably detect anthrax spores, without consuming or destroying the sample and without requiring specialist knowledge and training in chemistry or biology. Unfortunately technology limitations mean such a device has been unavailable.

An emerging technology is about to change this availability problem. Optical Recognition Protocol technology has the ability to detect as few as 100 anthrax spores in powder or liquid samples, in less than 10 minutes, without physically contacting or destroying the sample. Applying this technology, Veritide™ has produced the Ceeker™ – a handheld bacterial spore detector that is as easy to use as a flashlight. The detector represents a significant breakthrough in frontline biological threat detection systems.

This white paper introduces the Ceeker™, compares it to other detection products, and illustrates how it can assist first responders to safely and efficiently deal with white powder incidents.

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The scenario

An unidentified powder spills from an envelope. The location may be a busy downtown office, a crowded airport, a postal center, a school or a public building. The location is not important. What's important is that first responders find out what they are dealing with and find out quickly.

Does the powder pose a health threat? Is it a hoax? Is it a simple misunderstanding? Either way, businesses are shutdown, traffic flow is disrupted and victims are at breaking point. Critical decisions need to be made and they need to be made now. Yet public safety is paramount. Every decision needs to be reasoned, logical and justifiable. But most of all, every decision needs to be right.

First responders dealing with the dynamic realities of scenarios like this need a range of tools and equipment, all of which should ideally be the best available. To ensure safety and support the decision-making process, first responders especially need biological analysis tools that:

- Accurately detect bacterial spores, even at low concentrations.
- Are unquestionably reliable.
- Deliver clear and rapid results.
- Do not contaminate or consume the sample.
- Are portable and robust.
- Are easy and straightforward to use, even when wearing a chemical/biological protection suit.

Although this list of needs is relatively modest, technological limitations have historically left first responders without a truly useful frontline biological threat detection tool. Instead, a range of tools with varying strengths and weaknesses has emerged, without a clear best of class or preferred solution for first responders.

The current state of play

Since the anthrax attacks of 2001 a diverse range of threat detection tools has come onto the market. These tools fall into two fundamental categories: chemical analyzers and biological analyzers. As there are many effective chemical analyzers on the market, such as those employing Raman and near-infra red optical technology, this category is not discussed in this white paper.

Tools for the detection of biological threats are somewhat more problematic. No single tool has yet established itself with first responders as the widely preferred, cost-effective, handheld screening test for biological threats. This failure to meet market demand and expectations can be explained by the following shortcomings, which are found to various degrees in conventional biological analysis tools:

- A reliance on wet chemistry, heat or ultrasound. All of these consume or destroy sample material, limiting detailed laboratory-based analysis.
- Relatively complicated sample preparation with swabs, mixing or sample collection apparatus. These procedures are difficult to perform in full chemical/biological protection suits.
- Difficult to interpret or ambiguous results, requiring subjective interpretation or significant training and experience in order to reliably get the correct result.
- A general lack of sensitivity or accuracy. Many analyzers require as many as 1,000,000 spores in order to return a positive result. Yet some authorities rate exposure to as few as 8,000 *B. anthracis* spores as potentially fatal.

These shortcomings, especially the destruction of sample material and significant potential for false negatives due to poor sensitivity levels, mean that many agencies discourage white powder screening tests by first responders. Instead the favored approach is for first responders to collect the suspicious powder and send it for detailed laboratory analysis – a procedure that can take several days, maximizing lockdown times, disruption, costs, uncertainty and victim anxiety. These delays are particularly significant for suspected anthrax attacks, where treatment effectiveness and survivability decline rapidly with each day of delay.

Clearly, first responders faced with potential biological threats do not currently have the tools required to make rapid, accurate and confident decisions. What is needed is an easy to operate biological analysis tool that presents clear and accurate results without contaminating or destroying the sample. A tool with these features requires the commercialization of an innovative and non-invasive technology, such as a non-contact optical recognition device.

The Veritide™ Solution

Veritide™ has combined engineering and research teams to develop a bacterial threat detection system that is based on optical recognition protocols. The system's first iteration has already been tested by Veritide™ specialists and an independent national laboratory where it demonstrated the following capabilities:

- Detection of as few as 100 spores.
- Detection without contamination or consumption of the sample.
- Typical detection times of less than 10 minutes.

The key breakthrough achieved by this technology is clearly the optical recognition protocol, which eliminates wet chemistry and its inherent sample handling and sample destruction. With no wet chemistry or reagent-based sample preparation, optical recognition systems not only preserve the sample, they enable full automation and point and shoot style devices.

Leveraging the potential of optical recognition protocol detection systems, Veritide™ has systematically refined the technology into a one-button flashlight-like detector. With this system, detection of anthrax spores is a simple matter of pressing a button and reading a positive or negative response on an LCD display.

The Veritide™ detector, which runs on a rechargeable battery and weighs approximately 2 lb (0.9 kg), is currently undergoing final production engineering before release for independent testing and verification of actual production units.

The following table compares the Veritide™ detector with a range of traditional detection tools.

	Sample preparation required	Detection level	Response time	Sample destruction	Weight
Veritide™ Ceeker™	No	Down to 100 spores	Less than 10 minutes	No	2 lb (0.9 kg) approx
Response Bio – RAMP	Yes	From 1 million spores	Less than 15 minutes	Yes	4.6 lbs (2.1 kg)
GenPrime – PrimeAlert	Yes	From 1.1 million spores	5 minutes	Yes	12 lbs (5.4 kg) (total system)
TetraCore / Alexeter – BioThreat Alert	Yes	~ 100,000 spores	15 minutes – Test strip	Yes	Not stated
Idaho Technology – R.A.P.I.D.	Yes	Not stated	15 to 30 minutes	Yes	50 lbs (22.7 kg) (instrument and all accessories)

Although the Veritide™ detector's first commercial release will detect bacterial spores such as anthrax spores, the capabilities of optical recognition protocol systems are being expanded to detect specific spore species for specialized medical, food and water quality applications. Detection capability for viruses and vegetative bacteria is also being developed.

Conclusion

Optical recognition protocol technology represents a significant breakthrough in the field of handheld biological threat detection systems. Evidence that this technology will transform the market for handheld detection tools is supported by the technology's key advantages:

- No wet chemistry or sample preparation.
- No sample contact, contamination or consumption.
- Rapid, reliable and accurate results, down to threats as small as 100 spores.
- Compact and lightweight physical properties.
- Straightforward point and shoot operation that is as easy to use on the frontline as a flashlight.

When combined into a robust handheld tool such as the Ceeker™, these advantages enable first responders to make rapid, informed and confident decisions when faced with white powder incidents. The cost and time saving benefits of such decision making are well known to first responders.

With such powerful advantages and benefits it is likely that first responders will soon be familiar with optical recognition protocol detection tools. But how soon is soon? Check www.veritide.com or send an email to info@veritide.com for market release dates.