Defense Against Chemical and Biological Threats

Issue

The potential of a chemical or biological attack weighs heavily on those charged with protecting our nation's civilian and military populations and assets, both at home and abroad. To save lives, minimize economic impacts, and bring perpetrators to justice, decision makers must be able to prepare against an attack, and should an attack occur, quickly understand its nature and respond effectively. Given the complexity and range of possible chemical and biological threats, developing the best preparation and response strategies is a difficult process that must be based on sound science and analysis.

Solution

Drawing on experience dating back to the deadly 1995 sarin attacks in the Japanese subway, Sandia blends basic chemistry and bioscience with extensive national security expertise to help the nation strategically defend against chemical and biological threats. Because Sandia maintains comprehensive understanding and resources, we can bring the right people, knowledge, and tools together to address these issues. Our work provides insights on how attacks might occur, as well as technology-based systems for detecting, responding to, and recovering from events. As a result of these activities, we've developed and demonstrated high-impact solutions that are already enhancing our nation's security.

Anticipate and Prepare

Because the time, money, and resources for addressing this serious problem are limited, Sandia applies its proficiency in risk assessment and systems analysis to better understand potential attacks—from conception through response and restoration—so that policymakers can better manage potential risks.

For example, Sandia scientists are developing a method to assess various biological threat agents, so future research can concentrate on agents that pose the greatest risk. We've also explored what might happen if specific U.S. sites were attacked with specific biological and chemical weapons. Our detailed results are helping national leaders improve protection and response strategies by better allocating existing capabilities and filling crucial gaps.

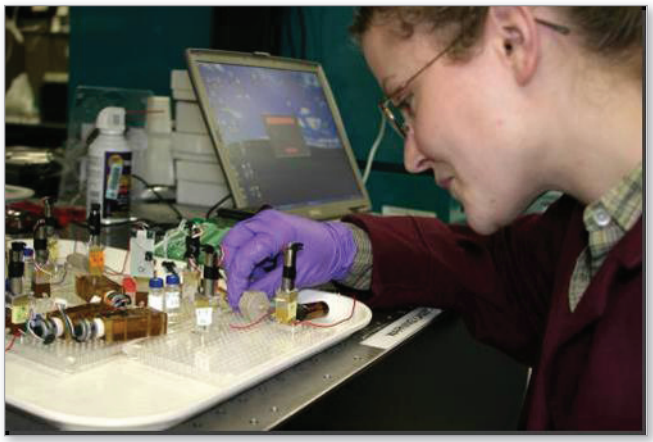
In addition, BioDac, a sophisticated Sandia interactive "gaming" environment that simulates a biological attack, helps policymakers both understand how attacks unfold and test the effectiveness of various potential responses. The ability to evaluate decisions in this environment can help policymakers devise responses more likely preserve lives and prevent damage.

Detect and Understand Attacks

Aware of the critical need for fast, inexpensive, highly sensitive, and mobile detection systems, Sandia invested internal research dollars into years of laboratory work that has resulted in novel micro-sized chemical and biological detection technologies.

We're actively applying these new technologies in a variety of ways. Our microfluidic systems are at the core of BioBriefcase, a mobile biodetection system being developed with Lawrence Livermore National Laboratory. Sandia is also working with industrial partners to integrate our technology into a system for automatic surveillance of our nation's water supplies and seeking industrial partners to commercialize palm-sized detectors for emergency responders.

Other Sandia work aims to resolve an array of detection problems. AURA, a payload designed for an airborne platform, uses ultraviolet laser-induced fluorescence (LIF) to differentiate between bioaerosols and other particles, such as dust or diesel fumes. Similarly, SnifferSTAR™ is a half-ounce, low-power sensor intended to ride on small aerial drones to detect possible nerve or blister gas attacks on cities or military facilities.



Sandia's advances in microfluidics and other areas have led to the development of hand-held detectors that could help first responders quickly assess if an attack has occurred—and move rapidly to save lives.

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

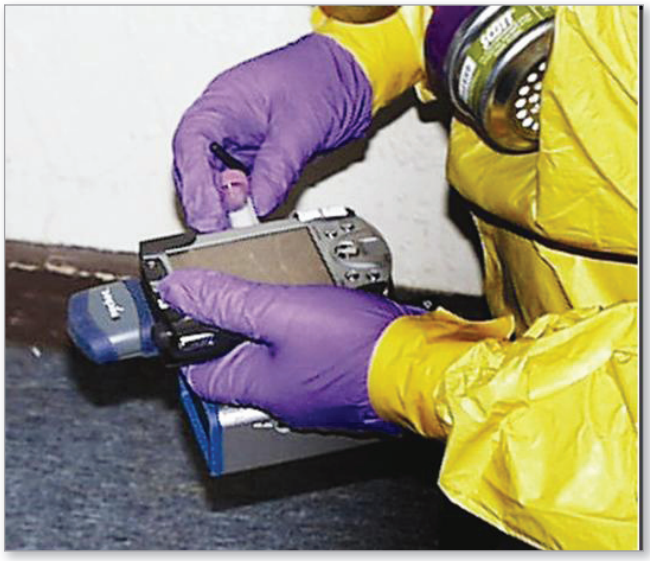
Sandia's FAME project, which can detect signature biomarkers from whole-cell fatty acid analytes in less than seven minutes, could lead to an early warning system for evaluating contaminated areas. Another Sandia project is helping to increase the detection accuracy of commercial LIF detectors by identifying the chemical and physical properties of the particulates that lead to false alarms.

Recover and Attribute

To mitigate the costly and complex problem of decontaminating buildings after an attack, Sandia has developed BROOM, a software-based tool for managing the collection, visualization, and analysis of environmental sampling data. Complete with aids for every step of the process—from planning through clean-up—BROOM can improve cleanup efficiency and provide a scientifically defensible basis for reopening a facility.

Sandia has also developed a foam that renders all typical chemical and biological agents harmless. Now commercially available, the foam was instrumental in cleaning up facilities after the anthrax letter attacks.

To aid in attack attribution, Sandia and other laboratories are applying advanced techniques to extract as much information as possible from the physical and chemical traces contained in biological evidence—traces that hold clues about when and where an agent was produced. When fully developed, Sandia's palette of techniques will help others identify and attribute signatures in field samples.



The BROOM system simplifies the process of collecting and processing the many samples needed to restore a facility after a biological attack.

Making a Difference

Above all, Sandia is intent on using our broad capabilities to provide real solutions that are making a measurable difference in our nation's ability to defend and respond to chemical and biological events.

For example, we've contributed to the development of BioWatch, a program that has placed networks of aerosol sampling units in major U.S. cities to help local officials gain early warning of a biological attack. To extend BioWatch to high-profile facilities, Sandia devised optimal architectures for locating the collectors inside each building and designed systems now used in major transportation hubs.

In addition, Sandia has led a team from many national laboratories to develop the prototype biological warning and incident characterization (BWIC) system. Assimilating information from a variety of sources—such as BioWatch, public health records, and plume and epidemiological models—BWIC provides key information to help decision makers better respond to attacks.

With our help, many critical Department of Energy sites are now better protected against chemical attacks. After assessing site vulnerability using our well-established process, our team developed and implemented site-specific defense plans.

We've also been active in efforts to defend transportation systems. We helped create PROTECT, a network of optical sensors, chemical detectors, and communications capabilities deployed in parts of the Washington, D.C. Metro system. In addition, we partnered with Lawrence Berkeley National Laboratory to publish guidelines to help airports prevent and respond to chemical and biological terrorism. The report is being distributed to airport security officials by the Transportation Security Administration.

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