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Sandia National Laboratories

Recent Accomplishments within Homeland Security and Defense

Sandia National Laboratories Makes Key Contributions to Anthrax Investigation

Sandia National Laboratories, a leading U.S. Department of Energy national laboratory, has particular expertise and culture to help the nation design, develop and implement risk-based systems solutions for high-consequence homeland security threats and national incidents. In response to 9/11, Congress passed legislation, in Section 309 of the 2002 Homeland Security Act, authorizing the DOE national laboratories to work with the Dept. of Homeland Security to help the agency fulfill its mission. Since then, Sandia has been leveraging its relevant expertise, capabilities, and facilities derived from its nuclear heritage and the large portfolio of work for other national security agencies.

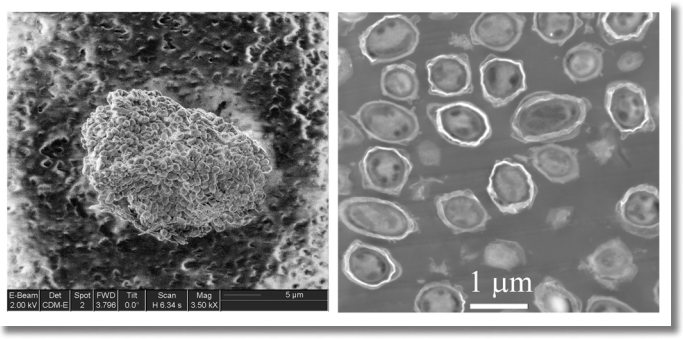
Homeland Security and Defense at Sandia has made numerous contributions to secure our society through effective deployment and use of science, technology and systems solutions.

As rumors of weaponized anthrax circulated in the media, Sandia National Laboratories was ascertaining key facts behind the 2001 anthrax attacks. In which, two mysterious series of letters containing bacillus anthracis bacterium were mailed to the press and to two U.S. senators. Five people who handled the letters died and others were hospitalized.

Sandia's Contribution

The FBI contacted Sandia to help find answers that only experts at a world-class facility could uncover.

Applying advanced technologies, Sandia researchers were soon able to inform the FBI that the anthrax spores were, in fact, not weaponized. This crucial finding told the FBI that the attack was likely not an act of state-sponsored terrorism and the toxin probably was not from an organized biological weapons program in another country. Further, Sandia studies found the same chemical fingerprint on different samples. This indicated that various samples had originated from a single source. Sandia made these discoveries within a month of receiving samples. However, that research was not made public during an ongoing investigation.



bacillus anthracis spores as viewed in SEM (left) and TEM (right).

Already deadly in its natural state, anthrax becomes more so when weaponized. This process coats the spores to make them more disbursable. Initial examination by a different laboratory indicated that the spores were coated, but Sandia found this to be incorrect.

Specialized Capabilities

Decades of research to support nuclear stewardship have prepared Sandia to conduct other kinds of groundbreaking studies, as well, in support of national security.

The FBI chose Sandia to assist in the anthrax investigation because of expertise in electron and ion microscopies as well as microanalysis over the range of length scales from millimeters down to nanometers. In 2002, the FBI began sending Sandia samples of bacteria spores. However, before sending them to Sandia, the FBI irradiated the toxin to neutralize it. There were no other laboratories doing this work. Other laboratories received live anthracis spores because they have the expertise to handle them and they studied the DNA, which radiation destroys.

Materials Characterization

For six and a half years after the attacks, Sandia's Materials Characterization department supported the FBI investigation of the anthrax attacks. Researchers signed nondisclosure agreements and agreed to be available on short notice to government agencies.

Sandia's Materials Characterization Laboratory provides an analysis resource for diverse projects. Crucial to

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National Nuclear Security Administration

stockpile surveillance, the laboratory supports Sandia's nuclear weapons mission. Equipped with powerful microscopes, Sandia researchers can observe the tiniest objects—even a single bacterium spore—and analyze its chemical makeup.

Principal investigator Joseph Michael, along with transmission electron microscopy (TEM) lab owner Paul Kotula and about a dozen others analyzed approximately 200 spores. They did not look or analyze bacteria, but instead looked at and analyzed spores samples. The samples were taken from letters mailed to *The New York Post* as well as to former Sen. Tom Daschle (D-S.D.) and Sen. Patrick Leahy (D-Vt.). Initial examination was complicated by the fact that the samples looked different because of how they were prepared.

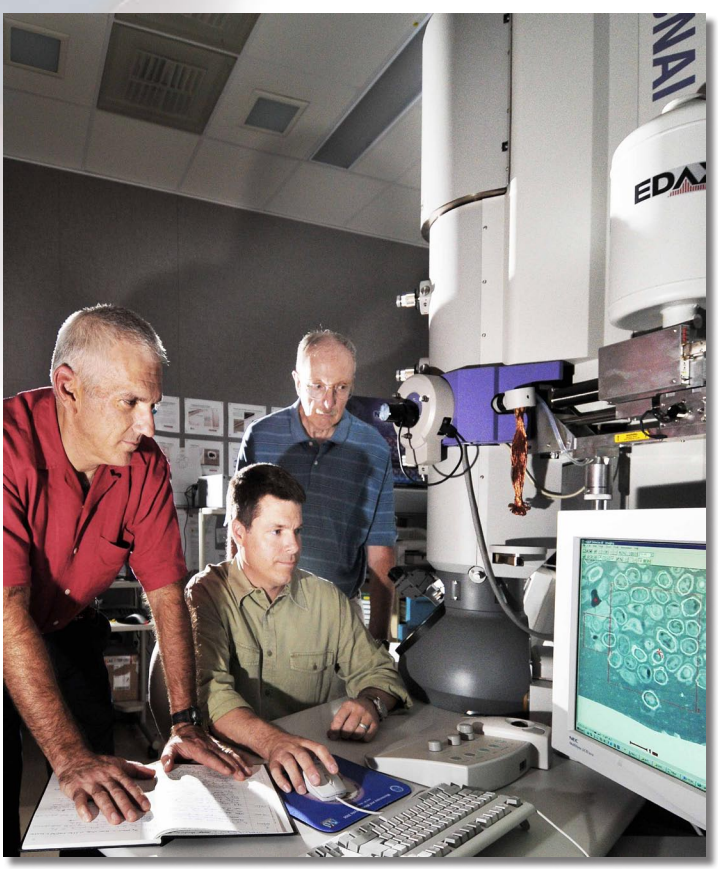
To weaponize *bacillus anthracis*, spores may be coated with silica nanoparticles. Under a microscope, these tiny flecks like lint. The coating makes the particles "bouncier" and less likely to clump and fall to the ground. Spores then become more respirable and can cause greater harm, said Michael.

Transmission Electron Microscopy

Conducted at another laboratory, scanning electron microscopy [SEM] found high silicon and oxygen signals on the samples. Initially, this suggested the spores had been weaponized, Kotula said. However, "the possible misinterpretation of the SEM results arose because microanalysis in the SEM is not a surface-sensitive tool," he added. "Because a spore body can be 1.5 to 2 microns wide by 1 micron long, a SEM cannot localize the elemental signal from whole spore bodies." Sandia was the first team to alert the FBI that the spores in all the letter-attacks (on *The New York Post*, Daschle, and Leahy) had a common signature and were not weaponized. These elemental signatures—and their locations—suggested that the spores had originated in the same source laboratory. DNA studies corroborated Sandia's findings

Top-Secret Effort

While the Michael-Kotula team worked at Sandia, scientists at other laboratories and universities nationwide also assisted the FBI investigation—none were aware of the others. Only in late summer of 2008 did Michael learn of the genetic analysis that pointed to what the FBI determined as the source of the bacteria. Only recently did the Sandia team learn they had analyzed samples from that source. Released from a nondisclosure agreement, Michael flew to Washington, D.C., in August 2008 for press conferences at FBI Headquarters. Other members of



Sandia's material characterization analysts (from left to right) Joseph Michael, Paul Kotula, and manager Ray Goehner.

research teams who assisted in the anthrax investigation also attended.

Making a Difference

Our work assisting in the national anthrax investigation underscores Sandia's efforts to make enduring and effective contributions to homeland security at the highest levels to secure society against high-consequence terrorist threats and national incidents through effective use of science, technology, and systems solutions.

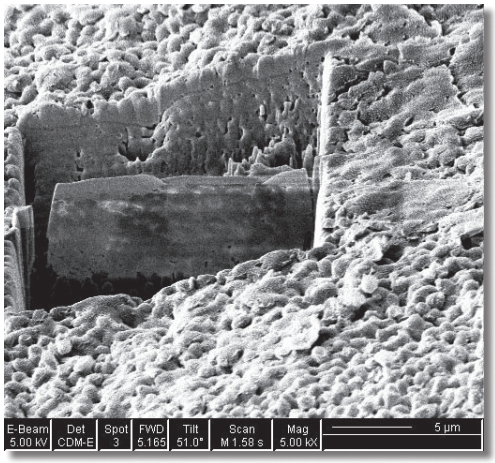


Image of a TEM sample prepared from a clump of spores from one of the attacks.

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