

Environmental Health Laboratory

Responding to Chemical Threats

National Center for Environmental Health
Division of Laboratory Sciences





Laboratories are key to a chemical threat response

Chemical emergencies have the potential to cause widespread human death and disease. The Centers for Disease Control and Prevention's (CDC) National Center for Environmental Health plays an important role in defining how public health responds to intentional and unintentional chemical emergencies. It does this through the Emergency Response Branch of its Division of Laboratory Sciences (DLS). CDC's environmental health laboratory develops and performs unique tests to assess chemical exposure during a public health emergency or terrorist event.

Laboratory support provides rapid detection and accurate identification of chemical threat agents which are crucial for diagnosis, detection, treatment and prevention of disease.

The DLS Emergency Response Branch offers an emergency response team, rapid toxic screen, and laboratory response network to improve the detection of chemical threat agents by:

- Identifying chemical agents used
- Measuring human exposure levels
- Preventing further exposure



Each year, DLS Emergency Response Branch responds to about 20 requests to analyze samples related to chemical emergencies. Current DLS capacity is 500 samples in 72 hours.



Chemical Emergency Response Team

CDC maintains 24-7 laboratory response capability. Within two hours of a request, the agency can deploy a Chemical Emergency Response Team to assist with specimen collection, packaging, storage, and shipment. CDC works with state and local officials to collect samples and transport them to CDC for analysis.

Rapid Toxic Screen

Rapid Toxic Screen (RTS) is a series of methods used to identify and measure more than 150 chemical threat agents in blood or urine. It provides important exposure information to medical, public health and law enforcement personnel. In a mass chemical exposure event, samples prioritized by epidemiologists are analyzed to identify the agent and guide further laboratory testing, medical treatment, and medical follow up. During non-emergency periods, DLS transfers many methods in RTS to participating state and local public health laboratories to build their capability in measuring chemical threat agents and surge capacity during mass exposure incidents.

Laboratory Response Network-Chemical

CDC partners with the Laboratory Response Network-Chemical (LRN-C), a national network for responding to chemical terrorism and other public health emergencies. LRN-C integrates 54 state and local public health laboratories that operate 24/7 to provide laboratory diagnostics and the surge capacity for chemical emergencies.

The DLS Emergency Response Branch provides the LRN-C with support service that includes:

- Agent-specific protocols
- Electronic messaging
- Full- scale training exercises
- Lab referral directory
- Proficiency testing
- Secure communications
- Standardized reagents and controls
- Training and technology transfer





Method Development

DLS Emergency Response Branch establishes methods to assess exposure, ensure quality, and enable response readiness. The method development process (Figure 1)

- Expands capacity for additional threat agents and compounds of interest
- Increases post-exposure time by using adduct methods and enhancing method sensitivity
- Improves methods by increasing speed and specificity



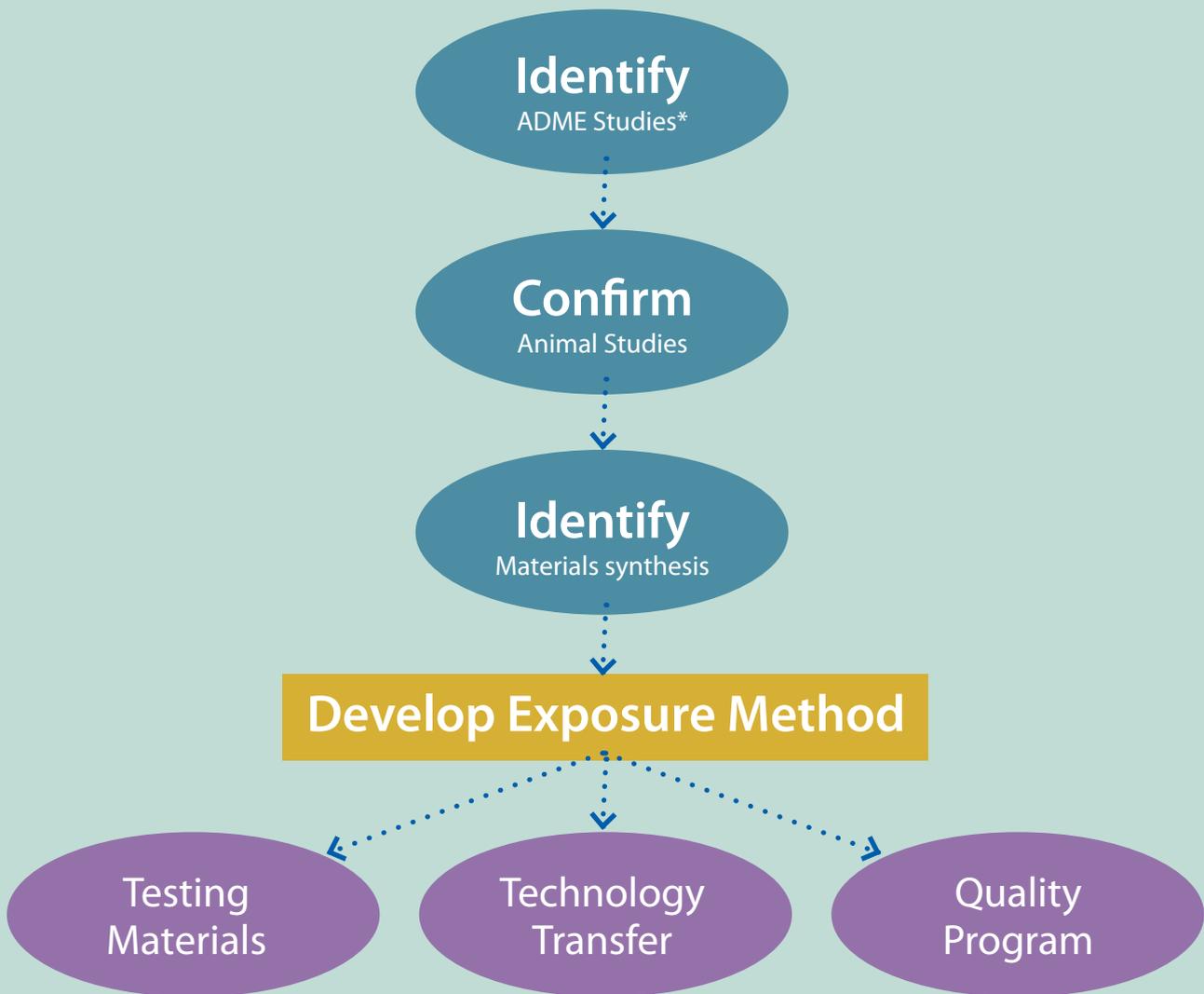


Figure 1 - Method Development

*ADME stands for Absorption, Distribution, Metabolism, and Excretion studies



NCEH scientists use advanced instrumentation techniques—such as sample prep automation, liquid chromatography, and mass spectrometers—to improve the detection of chemical threat agents for several chemical classes (Table 1). Scientists use absorption, distribution, metabolism, and excretion (ADME) studies to determine which compounds can be used to identify exposure and what sample should be taken (i.e., blood or urine).

DLS Emergency Response Branch also coordinates a materials program for synthesis and preparation of standards and quality control samples. The program includes:

- Pre-manufactured standards and quality control samples
- Prepared samples for each method
- Custom synthesis
- Pilot and Quality Assurance testing

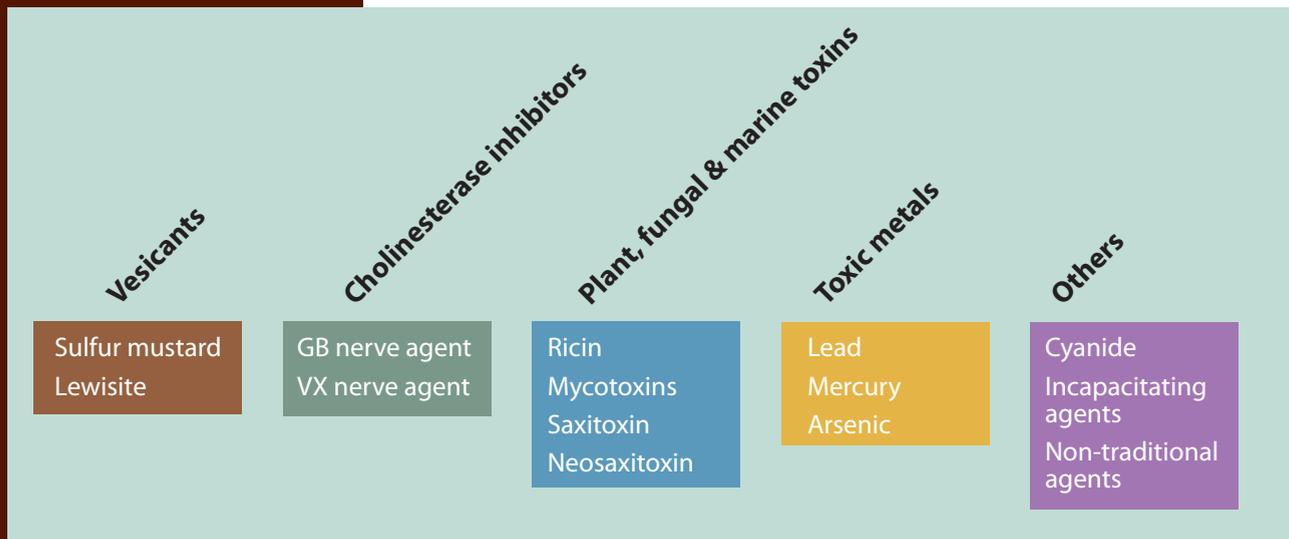
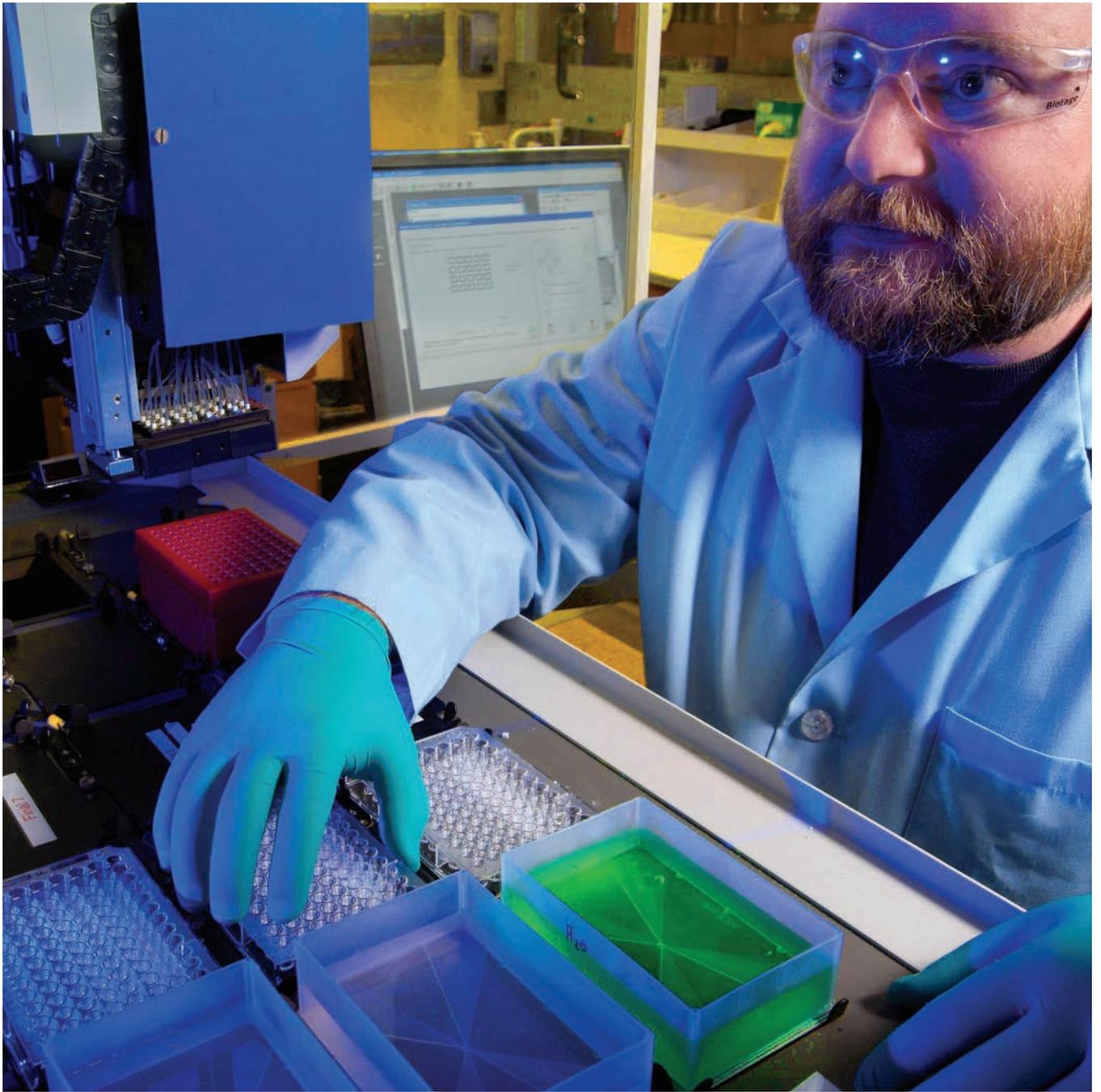


Table 1- DLS develops, evaluates, and applies innovative laboratory methods for a number of chemical classes





Preparedness 24/7

DLS Emergency Response Branch conducts ongoing preparedness activities, including

- Regular training for surge capacity laboratories
- Improving existing testing
- Developing methods for new chemical agents
- Expanding partnerships

Multipurpose Research

CDC methods for chemical emergency response also benefit non-event research. For example, toxin methods could be used to identify toxin-specific threat agents and also applied when a naturally occurring toxin is found in food. This is the case with marine toxins, which are natural toxins produced by harmful algae and occur throughout the world. People are exposed to these toxins by eating contaminated shellfish (e.g., clams, mussels, oysters). DLS researches these and other toxins—such as aflatoxin, anthrax, botulism, ricin, saxitoxin and neosaxitoxin—using advanced technology to diagnose and prevent toxin related diseases.





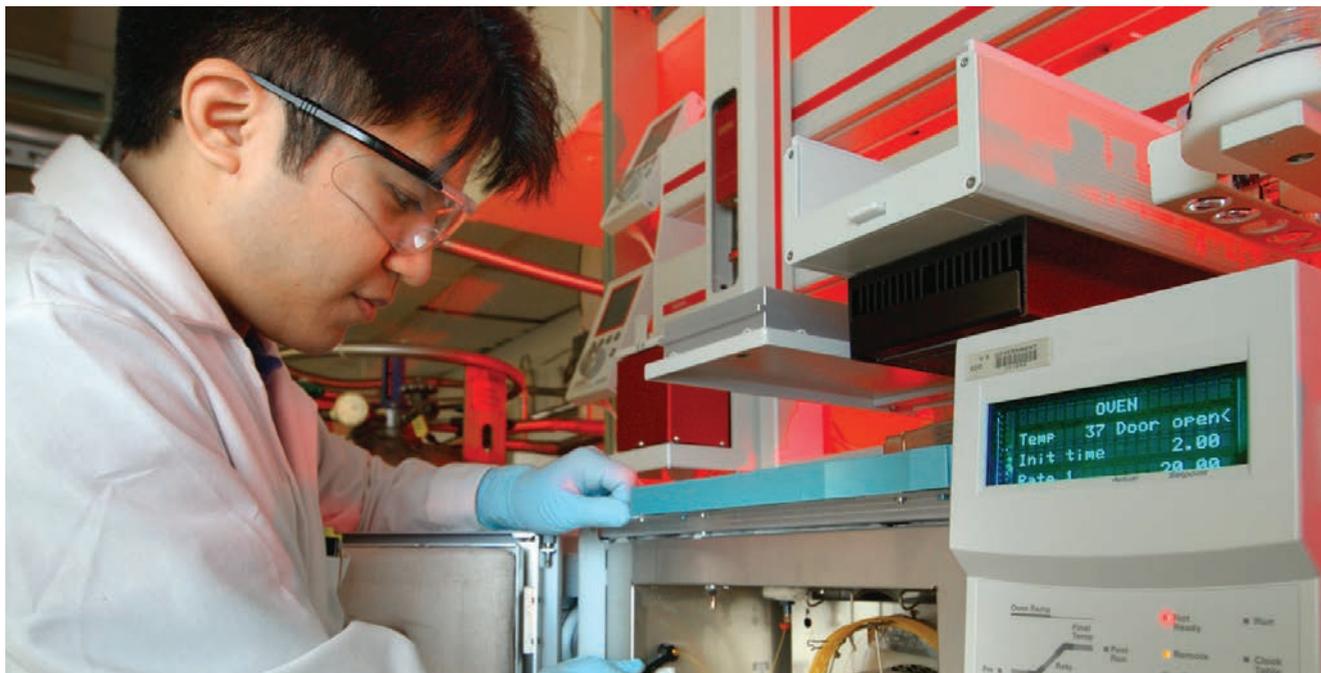
Proficiency Testing

CDC's DLS is certified under Clinical Laboratory Improvement Amendments (CLIA) and works to ensure high quality results through proficiency testing. CDC also helps LRN-C participating laboratories evaluate the quality of their results.

Training Exercises and Technical Assistance

Training is essential to ensure that all states and territories can package and ship samples properly, collect and analyze samples, and report and transmit laboratory data. CDC develops training curricula, offers technical assistance, and conducts annual exercises through LRN-C to improve the nation's ability to respond to chemical incidents.

Between 2009 and 2010, state and local laboratory training exercises decreased time needed for laboratory sample processing. The average time to process and report 500 samples by participating state Level 1 laboratories dropped from 98 to 56 hours.

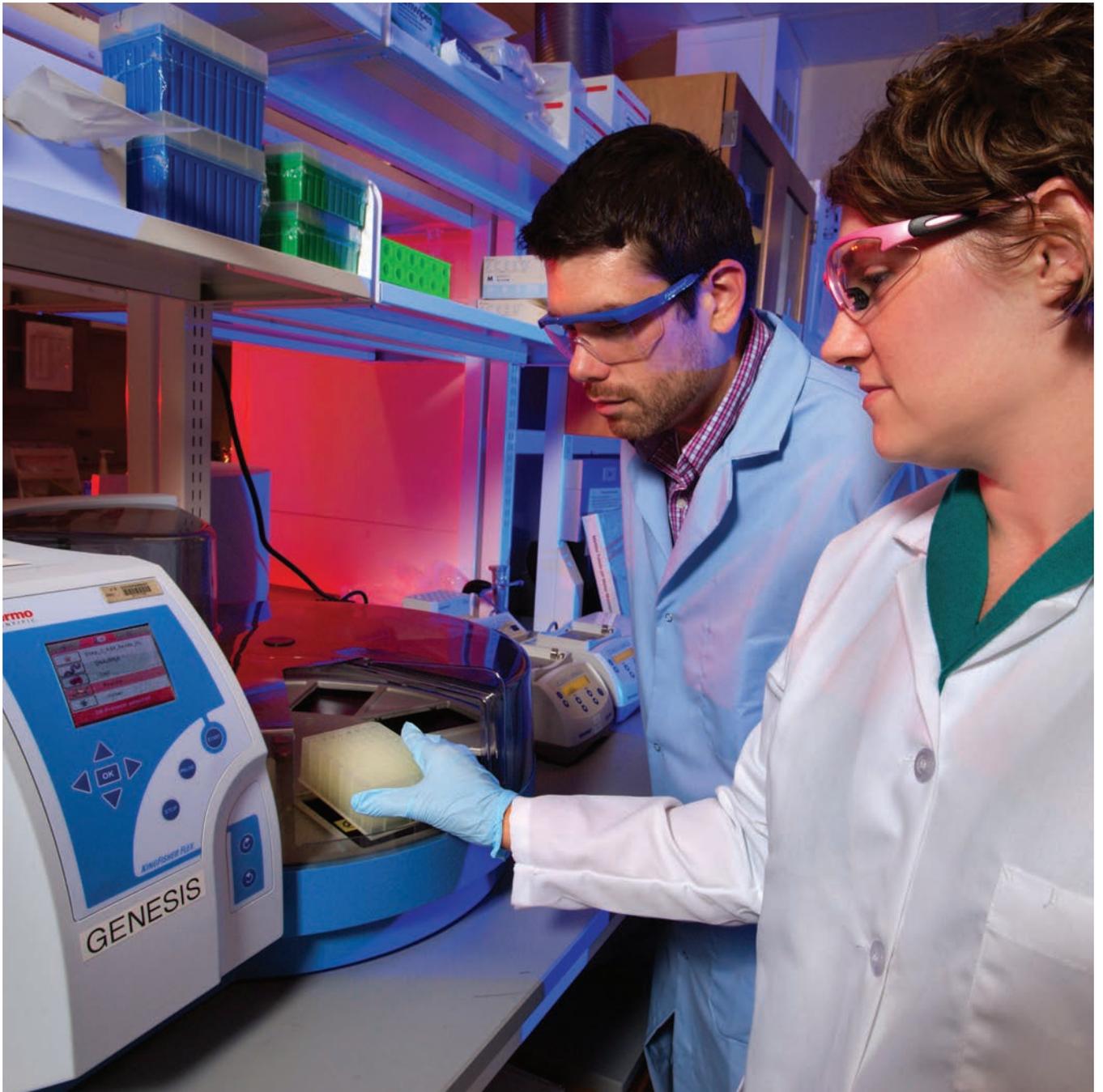


Advances for the Future

The threat of chemical terrorism constantly evolves. It is possible that a large-scale attack will include new mixtures of chemical agents. Because this poses a significant challenge, DLS's Emergency Response Branch continues to enhance its quantitative capabilities, develop qualitative identification of unknown chemical threats, and improve the accuracy and timing of existing methods.

Scientists at the DLS Emergency Response Branch are working to:

- Expand the Rapid Toxic Screen to include more chemical threat agents
- Develop new and refine existing methods to shorten identification time and improve quality
- Expand training and delivery of biomonitoring methods



Coordination and Partnership

CDC supports state and local public health laboratories by designing, developing, and transferring high-quality testing practices and offering technical consultation, training, and high-priority supplies not available from other sources.

CDC collaborates with the Organisation for the Prohibition of Chemical Warfare (OPCW), which serves as the chemical arm of the United Nations. CDC's Environmental Health Laboratory is designated to provide OPCW with biomedical testing.

Partnerships with universities, industry-based scientists, and professional associations help develop diagnostic methods for exposure to chemical threat agents. During public health emergencies, CDC coordinates with the following federal agencies and organizations:

- Association of Public Health Laboratories
- Federal Aviation Administration
- Federal Bureau of Investigation
- U.S. Food and Drug Administration
- U.S. Army laboratories
- U.S. Army Medical Research Institute of Chemical Defense
- Edgewood Chemical and Biological Center
- U.S. Department of Defense
- U.S. Department of Energy
- U.S. Department of Homeland Security
- U.S. Environmental Protection Agency



CDC is the nation's health protection agency, working 24/7 to protect America from health and safety threats, both foreign and domestic. Whether exposures start at home or abroad, are chronic or acute, human error or deliberate attack, CDC supports communities and citizens to prevent it.

Resources

Contact DLS Emergency Response Branch

Email address: ncehdls@cdc.gov

Phone: 800-CDC-INFO (800-232-4636)

Division of Laboratory Sciences

<http://www.cdc.gov/nceh/dls/>

National Center for Environmental Health

<http://www.cdc.gov/nceh/dls/index.html>

Agency for Toxic Substances and Disease Registry (ATSDR)

<http://www.atsdr.cdc.gov/>

Emergency Preparedness and Response: Chemical Emergencies

<http://emergency.cdc.gov/chemical/>

Laboratory Information for Chemical Emergencies

<http://emergency.cdc.gov/chemical/lab.asp>

Laboratory Response Network (LRN)

<http://emergency.cdc.gov/lrn/>