



Prepare, Detect and Respond: Public Health Laboratories on the Frontlines



A Report of the APHL 2014 All-Hazards Laboratory Preparedness Survey



APHL ASSOCIATION OF
PUBLIC HEALTH LABORATORIES®



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- Indiana State Department of Health Laboratory
- Los Angeles County Department of Public Health, Public Health Laboratory
- Maine Health and Environmental Testing Laboratory
- Missouri State Public Health Laboratory
- State Hygienic Laboratory at the University of Iowa
- Virginia Division of Consolidated Laboratory Services
- West Virginia Department of Health and Human Resources



The Katherine A. Kelley State Public Health Laboratory's full-scale exercise for biological terrorism preparedness.

Executive Summary

As front-line defenders of national security, public health laboratories (PHLs) provide critical services to effectively prepare for, detect and respond to all threats. On a daily basis, PHLs work to detect threats such as anthrax, influenza and Ebola. Far from nightly news cameras, these laboratories examine suspicious “white powder” letters sent to political officials and others. They respond to environmental disasters such as oil spills and other chemical accidents to determine exposure to harmful contaminants as well as to determine whether water is safe to consume. In many states, these same laboratories test food to ensure it is safe and also test human clinical samples and food to determine the cause of foodborne illnesses. In disasters, these laboratories ensure continuity of operations for critical services such as newborn screening — the process of screening newborns for genetic and metabolic conditions and hearing loss. These laboratories represent an essential component of the public health system.

The Association of Public Health Laboratories (APHL), a national nonprofit organization with over 800 members, works to assure that state and local governmental health laboratories have the necessary resources and systems in place to protect the health of the United States (US) population and to prevent and control diseases globally. In fulfilling its mission, APHL conducts an annual assessment of the ability of the 50 state, District of Columbia, Puerto Rico, Los Angeles County and New York City PHLs to prepare for and respond to chemical, biological and radiological threats, natural disasters and emerging threats such as Ebola. These annual assessments provide valuable benchmarks, which measure both progress and challenges in laboratory preparedness and response.

The *2014 All-Hazards Laboratory Preparedness Survey* data were collected by APHL in the fall of 2014 covering the 12-month period from July 1, 2013–June 30, 2014. APHL received a 100% response rate. Data obtained from the *2014 APHL All-Hazards Laboratory Preparedness Survey* highlighted the numerous contributions of PHLs. A major success continues to be seen in the collaborative approach of the US Centers for Disease Control and Prevention (CDC) in managing the Laboratory Response Network (LRN) and utilizing this network to respond not only to acts of terrorism, but also to naturally-occurring public health threats.

The concept of leveraging the LRN infrastructure — a network of laboratories with skilled personnel, communications systems, electronic data messaging platforms, quality system of tests and reagents — is not new. In past years, the LRN has been used most notably to respond to outbreaks of West Nile virus and Severe Acute Respiratory Syndrome (SARS) as well as to human exposure to toxic chemical spills. In 2014, PHLs used their LRN resources to respond to natural disasters such as flooding that occurred in the central US, Middle East Respiratory Syndrome (MERS), dengue, chikungunya, a nationwide outbreak of *Cyclospora* and the Elk River, West Virginia chemical spill.

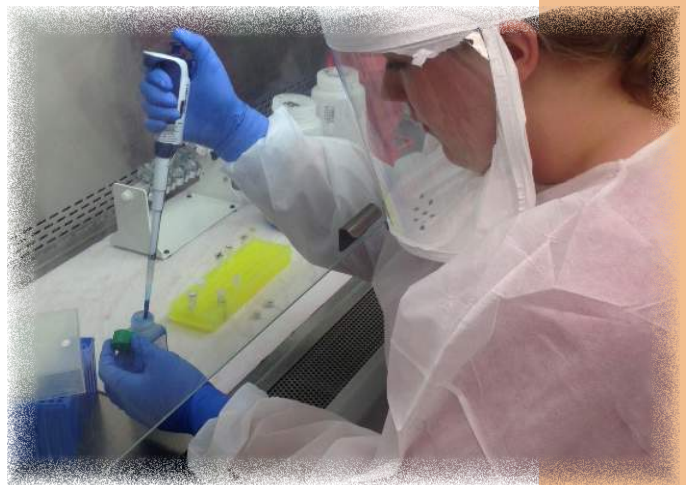
PHL members of the LRN have utilized declining federal funding such as the CDC Public Health Emergency Preparedness (PHEP) Cooperative Agreement to strengthen relationships between private, clinical and governmental laboratories; train personnel; procure molecular detection technologies; and maintain equipment and supplies to perform testing. This report will further elaborate on these successes and discuss collective challenges facing the public health laboratory system in the US.

Introduction

As front-line defenders of national security, PHLs provide critical services to effectively prepare for, detect and respond to all threats. On a daily basis, PHLs work to detect threats such as anthrax, influenza and Ebola. Far from nightly news cameras, these laboratories examine suspicious “white powder” letters sent to political officials and others. They respond to environmental disasters such as oil spills and other chemical accidents to determine exposure to harmful contaminants as well as to determine whether water is safe to consume. In many states, these same laboratories not only test food to ensure it is safe, but they also test both human clinical samples and food to determine the cause of foodborne illnesses. In disasters, these laboratories ensure continuity of operations for critical services such as newborn screening — the process of screening newborns for genetic and metabolic conditions and hearing loss. These laboratories are an essential component of the public health system working to protect the public’s health.

Although states had been receiving minimal federal funds to support PHLs since 1999, it was not until the 2001 terrorist attacks on the US that Congress dramatically increased appropriations for laboratory preparedness. CDC provides these funds via what is now known as the PHEP Cooperative Agreement, which is the primary mechanism for providing funding to state and large local jurisdictions to prepare for and respond to public health threats. According to CDC, “since 2002, the PHEP cooperative agreement has provided nearly \$9 billion to public health departments across the nation to upgrade their ability to effectively respond to a range of public health threats, including infectious diseases, natural disasters, and biological, chemical, nuclear, and radiological events (CDC, 2015).”

A key component of the PHEP Cooperative Agreement is “Public Health Laboratory Testing,” which is performed by the LRN biological and chemical components of PHLs. In 1999, CDC, the Federal Bureau of Investigation (FBI) and APHL established the LRN — the nation’s premier system for identifying, testing and characterizing potential agents of biological and chemical terrorism. The foundation of the LRN is a unified operational plan and standardization of laboratory testing, so that a test result generated from one LRN member laboratory is the same as a result generated from another network laboratory, thus providing rapid, high-confidence results to inform public health decisions. The network has many strategic partners, which allows for coordination among federal, state, and local public health agencies, clinical laboratories, first responders and law enforcement.



Virginia Division of Consolidated Laboratory Services (DCLS) LRN Molecular Scientist Mary Kathryn Dickinson aliquots lysis buffer in preparation for external lysis and nucleic acid extraction procedures on the MagNA Compact nucleic acid extraction platform in the Bioterrorism-Bacti Environmental BSL-3 laboratory at DCLS.

Mission of the LRN

The LRN is a national security asset that, with its partners, will develop, maintain and strengthen an integrated domestic and international network of laboratories to respond quickly to biological, chemical and radiological threats and other high-priority public health emergency needs through training, rapid testing, timely notification and secure messaging of laboratory results.

The Laboratory Response Network for Biological Threats Preparedness (LRN-B)

When the LRN was first established in 1999, the primary focus was to prepare for and respond to potential bioterrorism events. In fact, the preparation efforts of the network enabled the US to have a rapid and extensive response to the 2001 anthrax attacks. Lessons learned from this response were used by APHL and CDC to strengthen outreach to clinical laboratories and first responders and to develop tools to assist laboratories in planning for surge capacity. Over the years, the LRN mission has expanded to include response to chemical threats and other public health emergencies, such as severe acute respiratory syndrome (SARS), monkeypox, influenza A virus subtype H5N1 (avian influenza), influenza A virus subtype H1N1 (2009 pandemic influenza), and, in 2014, the MERS coronavirus (MERS-CoV) and Ebola virus. Today's vision for the LRN-B is a laboratory system for rapid, high-confidence results to inform critical public health decisions about biological threats.

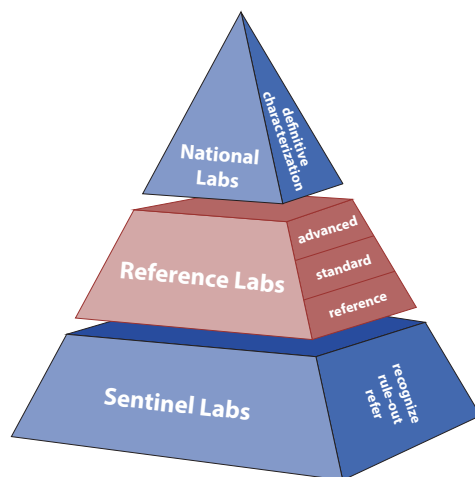


Image 1: The LRN Structure for responding to Biological Threats. National, reference and sentinel clinical laboratories work as an integrated network that builds upon individual laboratory capacity to respond to public health emergencies.

The LRN-B is organized as a three-tiered pyramid (see Image 1). At the base are thousands of sentinel clinical laboratories, which perform initial screening of potential biological threat agents. When sentinel clinical laboratories cannot rule-out the presence of a threat agent, they refer specimens and isolates to an LRN reference laboratory. Initially, there were just 17 LRN reference laboratories. Today, more than 140 state, local and federal facilities provide reference testing, producing high-confidence test results that are the basis for threat analysis and intervention by both public health and law enforcement authorities. State and local public health laboratories comprise approximately 70% of the 140 LRN-B member laboratories. At the apex of the pyramid are national laboratories such as those at CDC and the Department of Defense (DoD). National laboratories primarily provide specimen characterizations that pose challenges beyond the capabilities of reference laboratories, and they provide support for other LRN members during a serious outbreak or terrorist event. The most dangerous or perplexing pathogens are handled only at national laboratories such as CDC, the US Army Medical Research Institute of Infectious Diseases (USAMRIID) and the Naval Medical Research Center (NMRC). Typically, these national laboratories have biosafety level 4 (BSL-4) facilities and can perform highly specialized testing.

The Laboratory Response Network for Chemical Threats Preparedness (LRN-C)

In addition to detecting biological threats and emerging infectious diseases, there are two other core areas of LRN: chemical and radiological threats.

The LRN-C, established in 1999, originally comprised CDC laboratories and four public health laboratories. Now, the LRN-C network encompasses 55 laboratories. Of those 55 laboratories, nine are qualified to package and ship clinical specimens for chemical threat analysis (Level 3), 35 can test for exposure to toxic chemical threat agents (Level 2) and 11 (10 state public health laboratories and CDC) can test for exposure to additional threats, such as mustard agents, nerve agents and industrial chemicals (Level 1). The Level 1 laboratories can provide 24/7 analyses in a large-scale event. (see Image 2).

The initial focus of the LRN-C was to develop methods for detecting human exposure to chemical weapons. Today, the methods include a variety of different chemical threats that pose a public health risk, including a variety of toxins and poisons. Using quantitative mass spectrometry to detect chemical agents or their metabolites in urine or blood, LRN-C methods identify those individuals who have been exposed but do not display symptoms or injuries immediately following the incident. This is because the agent will most likely be known in an overt incident based on symptoms and injuries. For those with obvious symptoms or injuries, detecting exposure or the extent of exposure to the agent is probably not necessary. LRN-C also helps alleviate the concerns of individuals worried about exposure.

Currently, the LRN for Radiological Threats Preparedness (LRN-R) consists solely of CDC. Once funded, the broader network will be structured similarly to the LRN-C, with some laboratories having more advanced capabilities, others with more limited capability and still others with the capacity for packaging and shipping specimens to a laboratory with higher functionality.

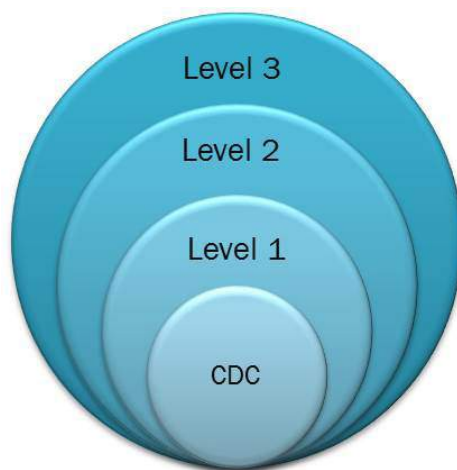


Image 2: The LRN Structure for Responding to Chemical Threats. A designation level of 1, 2 or 3 identifies laboratory capabilities and defines member network participation.

Methods

APHL collected data for the *2014 All-Hazards Laboratory Preparedness Survey* in the fall of 2014. The survey covered the 12-month period from July 1, 2013–June 30, 2014, representing the FY13 CDC PHEP Cooperative Agreement, Budget Period (BP) 2. PHLs reported on their capability and capacity to respond to biological, chemical and radiological threats as well as emerging infectious diseases.

The APHL *2014 All-Hazards Laboratory Preparedness Survey* was distributed to the 50 state PHLs, DC, Puerto Rico, New York City and Los Angeles County PHLs. This represents the first time APHL officially assessed preparedness capabilities of Los Angeles County and New York City PHLs as part of this survey. Data were collected using Qualtrics 5, a web-based survey tool and data repository. Each survey participant received an email with a unique survey link and a copy of the survey. APHL received a 100% response rate. The *2014 APHL All-Hazards Laboratory Preparedness Survey Summary Data Report* (available at: http://www.aphl.org/AboutAPHL/publications/Documents/PHPR_2014AllHazardsSurveyReport_52015.pdf) presents aggregate survey assessment results for all questions.

Descriptive statistics were gathered for all categories: demographics, funding and workforce, planning and response, biological threat preparedness, chemical threat preparedness and radiological threat preparedness. The following sections present stories and accompanying data that highlight the role of the laboratories and the importance of their partnerships in protecting the public's health.

Discussion of Key Findings

Prepare

Investment in PHL preparedness is essential to ensure that the system is available and capable of responding to threats. Over the years, the primary source of support for PHLs, PHEP funds, for preparedness and response activities have declined. The declining PHEP funding is troublesome for the PHL community and for overall national preparedness. Thirty-seven PHLs reported the following top five impacts of PHEP reductions:

1. Unable to expand capabilities for new assays/tests/methods
2. Unable to renew service/maintenance contracts
3. Unable to purchase critical equipment
4. Unable to participate in national meetings/conferences/training courses
5. Unable to hire staff due to lack of funds

Figure 1: CDC PHEP Cooperative Agreement Funding for Public Health Laboratories, FY99–FY13, Adjusted for Inflation

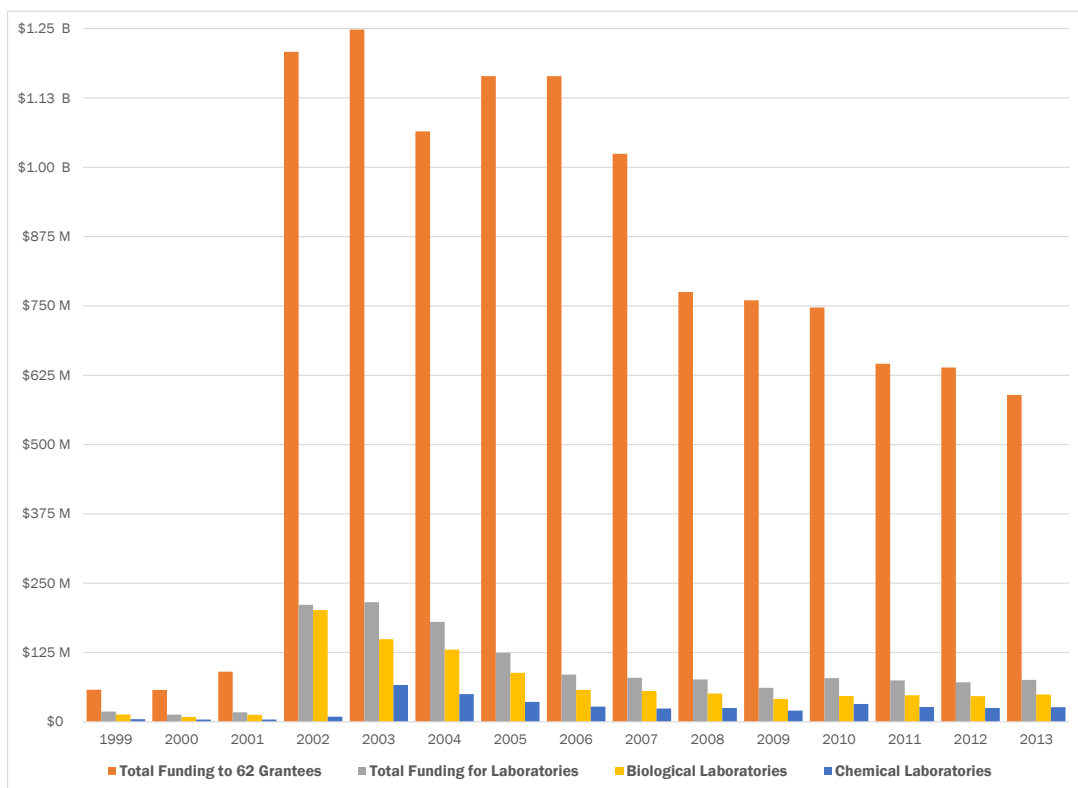
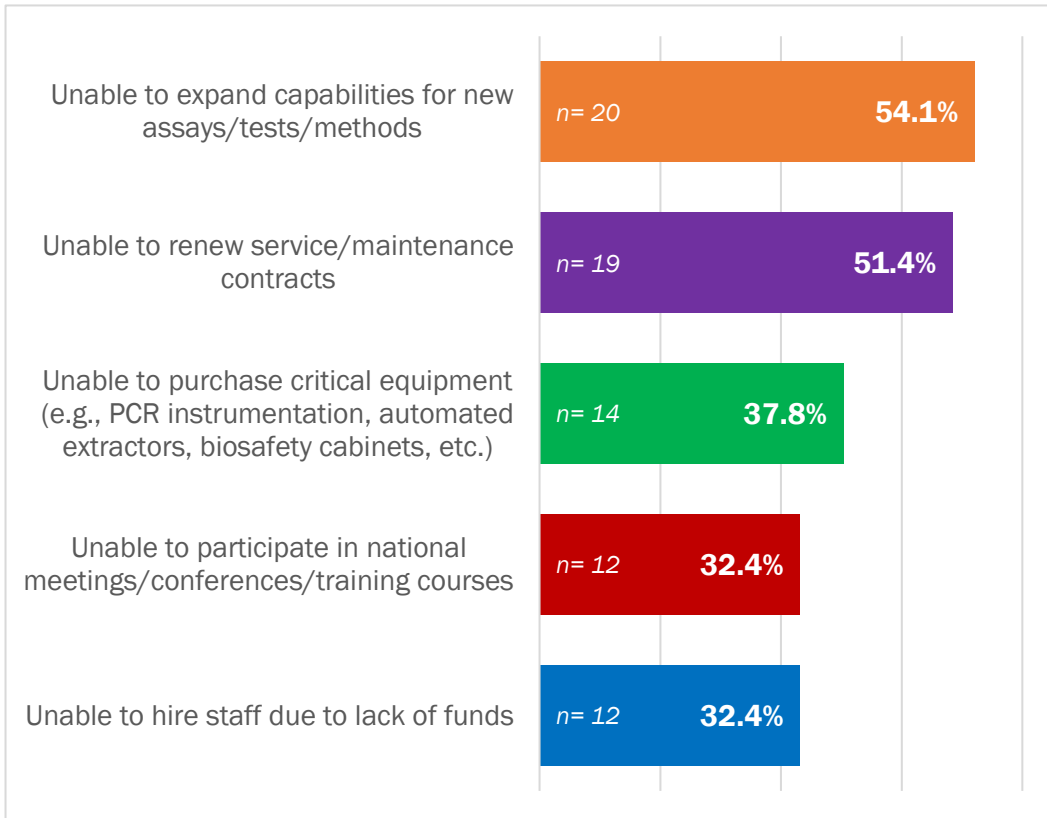


Figure 2: Top Five Impacts of Preparedness Funding Cuts on Public Health Laboratories



In FY13, respondents reported receiving \$83.3 million in federal funds for preparedness and response activities, 90% of which came from the CDC PHEP Cooperative Agreement. Funds provided to PHLs support priorities such as:

- A highly trained workforce
- Equipment procurement and maintenance
- Reagents and supplies
- Training programs
- Outreach to clinical laboratories and other partners

Figure 3: FY13 Allocation of CDC PHEP Cooperative Agreement Funds for *Biological Threat* Laboratory Preparedness

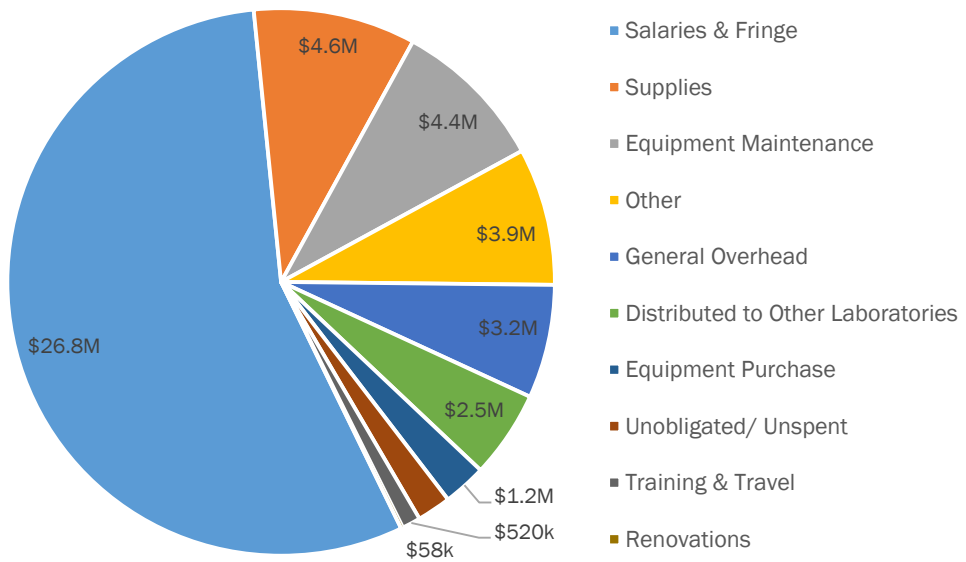


Figure 4: FY13 Allocation of CDC PHEP Cooperative Agreement Funds for *Chemical Threat* Laboratory Preparedness

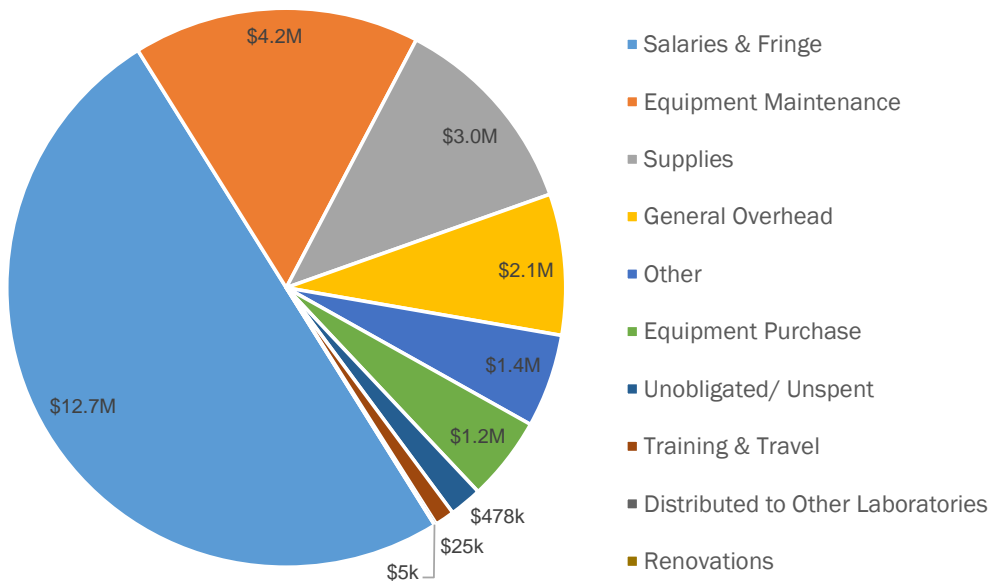
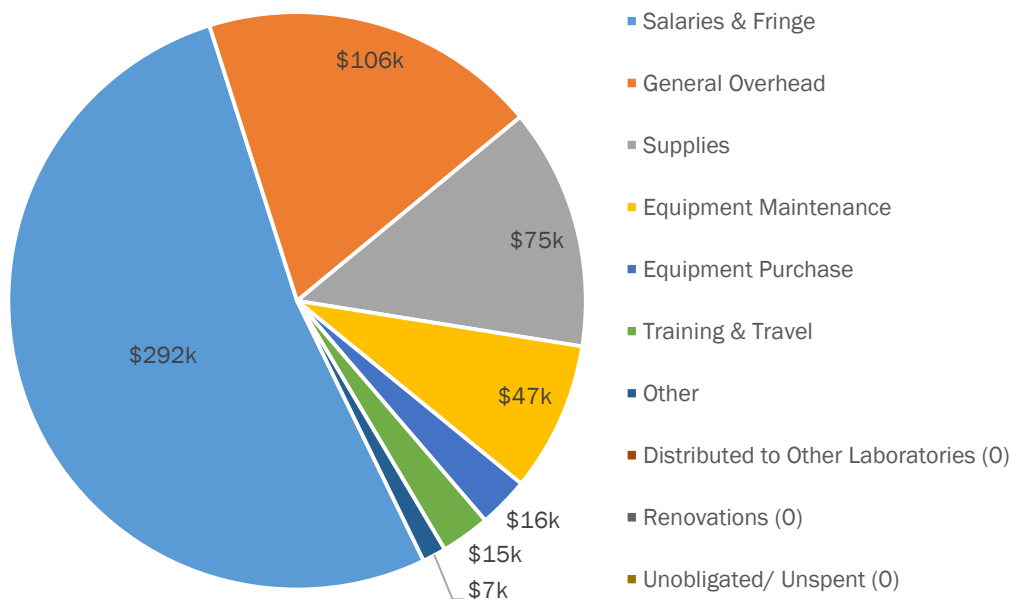


Figure 5: FY13 Allocation of Funding for Radiological Threat Laboratory Preparedness



Reduced funding since 2001 has impeded chemical and radiological threat activities the most. Almost 10% of LRN-C laboratories have seen decreases in funding during the last fiscal year, which resulted in reduced capabilities for responding to chemical threats. Capability was reduced primarily through the loss of chemical threat coordinator staff (60%), inability to maintain service agreements for equipment (60%) and overall reduced support of the broader chemical and radiological threat detection and response system (20%).

Preparing the Workforce

LRN staff constitutes the bedrock of the program's success in preparing for emergencies. Yet, as a resource, competent staff is the most difficult element to obtain, and the hardest to keep.

PHLs in the LRN have the responsibility to maintain a level of appropriate readiness in order to respond quickly to incidents of terrorism, natural disasters, accidents and outbreaks. Much of the federal funding utilized by PHLs supports personnel who are trained and capable of responding to a variety of threats. Some states are also able to utilize federally-funded fellows, such as those participating in the APHL-CDC sponsored Fellowship Programs, to help boost their staffing.

Utilizing the Skills of Fellows to Support Laboratory Preparedness in Iowa

A major highlight of the emergency preparedness program for the State Hygienic Laboratory at the University of Iowa was the addition of an APHL Emerging Infectious Diseases (EID) Fellow, Drew Fayram. Drew came to the laboratory in August 2013, and has been working with the emergency preparedness coordinator regarding the management aspect of the program. His newly acquired skills were put to the test during the response to the Cyclospora outbreak in the summer of 2013. Even though this was not related to bioterrorism, it was a major disease outbreak nationwide and required significant coordination of resources. The State Hygienic Laboratory at the University of Iowa received 6,903 specimens from June through September 2013, and had to enlist the help of five other laboratories, including the Wisconsin State Laboratory of Hygiene, the Missouri State Public Health Laboratory, the Maryland State Department of Health and Mental Hygiene, the Georgia Public Health

Laboratory, and the Veterans Administration Hospital in Iowa City, IA. The total number of staff hours for the outbreak was 2,043. Preparedness funding was critical in this outbreak, supporting staffing as well as courier costs. Drew's assistance after this outbreak was critical as the situation required an all-hands-on-deck approach for laboratory personnel. Additionally, this incident provided Drew with a real life example of implementing an outbreak response protocol.



Specimen load at the State Hygienic Laboratory at the University of Iowa.



Drew Fayram, EID fellow at the State Hygienic Laboratory at the University of Iowa, prepares packages as part of an LRN-C exercise.



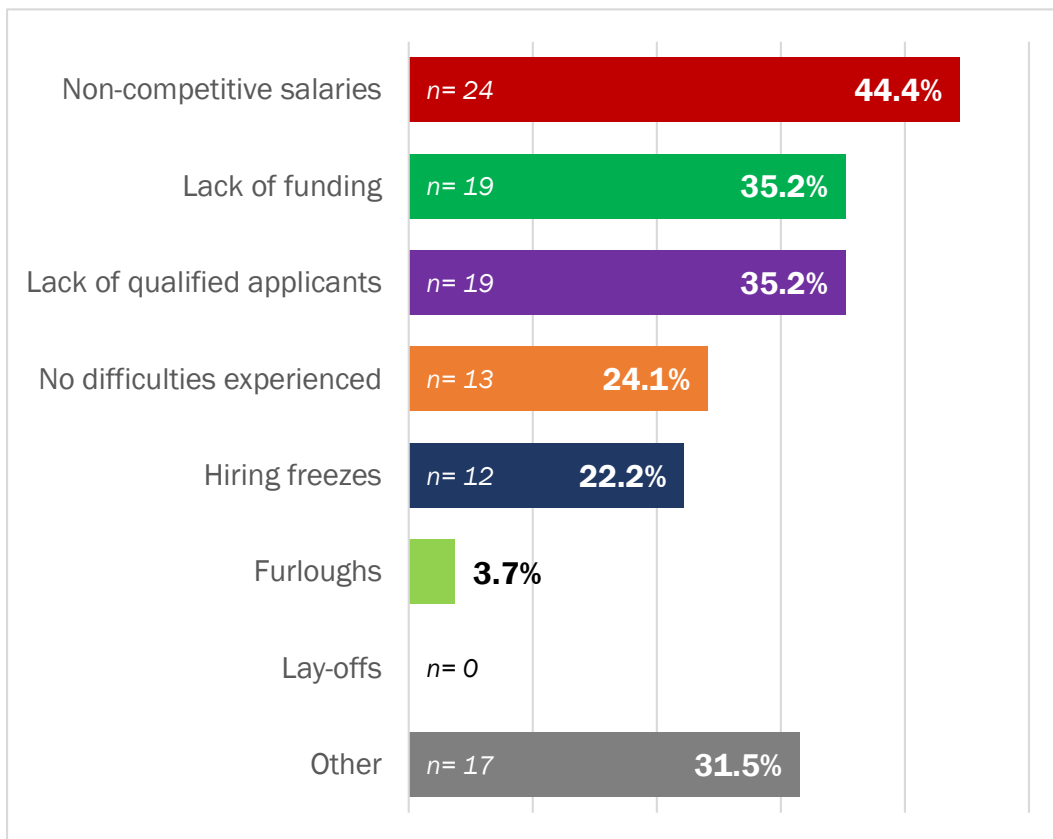
Drew Fayram and Jaye Boman, clinical lab analyst, conduct a bioterrorism wet workshop



Drew Fayram participates in a postal service exercise in May 2014

Although APHL fellows, as evidenced by Drew Fayram, display a willingness to perform their fair share of the workload during an emergency, they cannot take the place of full-time assigned staff in every laboratory. Workforce turnover can hamper emergency response and, as Figure 6 illustrates, this is occurring due to a plethora of issues.

Figure 6: Factors affecting PHLs Ability to Carry-Out Preparedness Activities



The need for competent PHL staff is evident in the scale of training that may occur over the course of a year. Should PHL staff fall behind in readiness and response training, the consequences to the public's health during an emergency could be severe. To ensure a capable and ready workforce, PHLs prepare their staff through exercises with partner agencies. During FY13, 54 laboratories reported performing 582 table-top, functional and full scale preparedness exercises.



The Katherine A. Kelley State Public Health Laboratory's full-scale exercise for biological terrorism preparedness.

Partnering for Full-Scale Exercise in Connecticut

In 2014, the Katherine A. Kelley State Public Health Laboratory, Connecticut's state public health laboratory, participated in a full-scale exercise with regional Civil Support Teams (CSTs) from New York, New Hampshire and Rhode Island, as well as the FBI, State Police Emergency Services Unit, USAMRIID, local fire departments and the police at Groton Airport. The exercise centered on intelligence that indicated a plane had landed containing terrorists with biological weapons. The Special Weapons and Tactics (SWAT) team responded to the terrorists with ammunitions and detained them while the aircraft was searched for evidence of biological weapons by the State Police Emergency Services Unit in Level A gear. FBI served as incident command partnering with the local fire and police authorities. The CST performed initial screening of samples while state public health laboratory personnel were on hand to accept samples via chain-of-custody. Several lessons on incident response and team coordination were gleaned by PHL staff during this training. However, the most interesting takeaway from the experience was discovering the difficulty of entering and searching a small aircraft in Level A gear. The exercise conducted in Connecticut demonstrates an excellent use of inter-agency cooperation and a dedication to remaining prepared to face any emergency situation.



FEMA Region I Emergency Training Exercise at Groton Airport in Groton, CT.

The training and maintenance of a competent and experienced workforce assists PHLs to prepare for all threats, including learning new and advanced technologies such as methodologies for antimicrobial resistance surveillance. Drug resistant organisms are responsible for approximately 23,000 deaths and about two million illnesses each year in the United States. The problem has become so widespread that the White House released a new funding initiative in 2015 focusing on strategies to stop drug resistance (The White House, 2015). The National Action Plan (NAP) for Combating Antibiotic-Resistant Bacteria is a five-year \$1.2 billion strategy that dedicates resources to surveillance, diagnostic testing and international collaboration (Burwell, Vilsak, Carter, 2015).

Combatting Antimicrobial Resistance

When the public's health is at risk and there is insufficient funding, several states have proven that innovation can still occur. The state of Maine recently responded to the international health community's call to action to combat the rising dilemma of antimicrobial resistance.

Via PHEP funding, the Maine Health and Environmental Testing Laboratory in 2014 began developing molecular diagnostic tests in the critical area of drug resistance. Specifically, the laboratory looked at resistance gene markers which enable a better understanding of these organisms and their impact on local communities. These genetic profiles directly contribute to improving surveillance measures of Carbapenem Resistant Enterobacteriaceae (CRE) in the local population. Additionally, the genetic profiles led to Maine's first identification of Carbapenem-*Klebsiella pneumoniae* (KPC-2). The identification of KPC-2 and subsequent development of diagnostic protocols offers laboratories, providers and epidemiologists the opportunity to tailor antibiotic therapy based on testing results.



Nick Matluk, the clinical microbiology section supervisor of Maine Health and Environmental Testing Laboratory, performs molecular diagnostic tests for validation of new methodologies to target drug resistant bacteria. The Maine Health and Environmental Testing Laboratory is one of many PHLs that are working towards the new White House directed goals for surveillance of drug resistance patterns in their communities.

Despite success stories like what has occurred in Connecticut and Maine, laboratories have encountered issues simply maintaining basic program functions. Chemical and biological positions in the Delaware Public Health Laboratory that had been grant funded were replaced with contract employees, leading to a higher turnover rate. Turnover has been particularly egregious in the chemical terrorism program, prompting the laboratory to downgrade from level 2 to level 3 status. In order to provide the highest level of emergency response, it is imperative that PHLs employ competent and experienced staff. Therefore, a high turn-over rate in these programs threatens the overall functionality of the network as a whole.

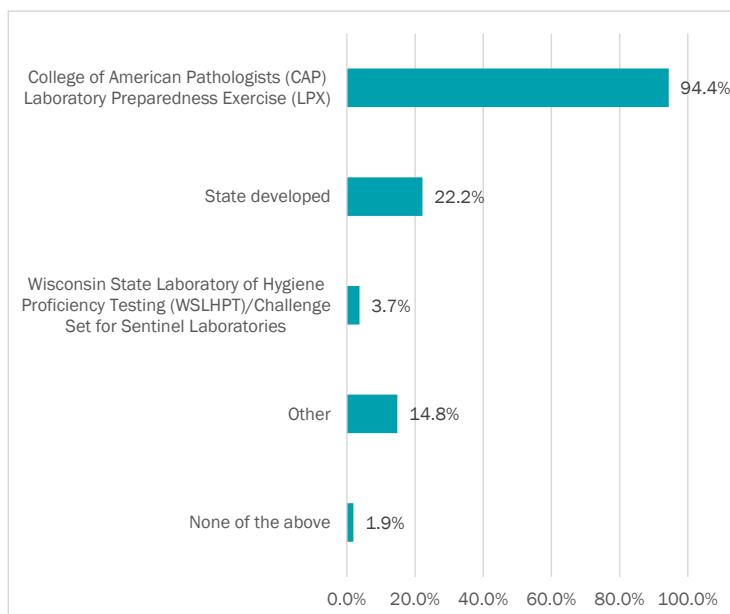
Supporting Sentinel Clinical Laboratories

Clinical laboratories testing human and animal samples are often the first interface with patients and the public health system. These laboratories perform a variety of critical tests, providing timely results to impact patient care. Optimally, these laboratories also work with local and state health departments to provide information on nationally notifiable diseases and other threats. While reporting of nationally notifiable diseases to CDC is not federally mandated, it is currently required by legislation or regulation at the state or local levels. As such, the list of reportable diseases varies slightly by jurisdiction. Ongoing communications and trainings from public health staff, including laboratorians and epidemiologists, help to assure that clinical laboratories are integrated into the public health system. This coordination is vital to the surveillance and responses for endemic and emerging pathogens, including identification of novel threats such as pandemic influenza and the development of appropriate countermeasures such as vaccines.

All 54 PHLs (100%) reported maintaining a database of active sentinel clinical laboratories within their jurisdiction. This database contains information such as the address of facilities and primary and 24/7 contacts for over 4,000 clinical laboratories across the US. Of note, 50 laboratories (93%) reported using the APHL, CDC and American Society for Microbiology (ASM) definition to identify their sentinel clinical laboratories. The remaining laboratories utilized a combination of this APHL, CDC and ASM definition with their internal guidance documents.

PHLs play an important role in engaging sentinel clinical laboratories. In FY13, 26 PHLs (48%) awarded 1,414 certificates of recognition to sentinel clinical laboratories in their jurisdictions. This represents an area where more can be done by PHLs to recognize sentinel clinical labs in the LRN and the larger public health system. In addition to maintaining databases with current information, PHLs provide training or assure access to training for sentinel clinical laboratories encouraging them to maintain competent staff knowledgeable in the ASM Sentinel Level Clinical Microbiology Laboratory Guidelines for Suspected Agents of Bioterrorism and Emerging Infectious Diseases. Further, PHLs utilize real events or develop and implement exercises to assess the functionality of the public health laboratory system,

Figure 7: Assessing Competency of Sentinel Clinical Laboratories to Rule-Out and Refer Biothreat Agents



such as the ability of sentinel clinical laboratories in their jurisdiction to correctly refer samples to the local or state public health laboratory. In FY13, 53 PHLs (98%) assessed the competency of sentinel clinical laboratories to rule-out and refer biological threat agents (see Figure 7).

The relationship between the sentinel clinical laboratory and the public health laboratory has proven to be essential for not only early detection of biothreat agents and possible biological terrorism events, but also for the early detection and notification of novel or newly-emerging diseases. An example of this partnership can be seen in the response to MERS-CoV where the Indiana State Department of Health Laboratory (ISDHL) and a local Indiana hospital laboratory (sentinel clinical lab) collaborated to detect this emerging threat. The story begins with a hospital staff member reaching out to the ISDHL for their assistance with testing a patient for MERS-CoV. Within just three hours of the ISDHL lab receiving the samples, a positive MERS-CoV case was confirmed and immediate infection control measures were implemented. This story was profiled in APHL's Lab Blog here: www.aphlblog.org/?s=indiana.



The Indiana State Department of Health Laboratories team confirms the first case of MERS-CoV in the US.

Detect

The time required to detect and confirm threats is critical to response efforts. In FY13, PHLs faced many emerging threats such as MERS-CoV and chikungunya to name a few. The LRN infrastructure of standardized protocols, electronic data messaging systems, communications platform and technical support allowed CDC to rapidly deploy new assays and the network of PHLs to quickly assume their roles in implementation of protocols for the detection of these threats. The flexibility of PHLs and the LRN enabled rapid detection of these novel viruses. As the primary source of confirmatory testing for diseases like the plague and anthrax, PHLs provide their local epidemiologists and other partners with the information needed for an emergency response.

Of the 4,000 samples analyzed for threat agents, PHLs tested over 1,200 letters, including 500 letters containing suspicious powders, food items and other substances.

PHLs utilize their scientific expertise for disease prevention, control and surveillance by providing accurate and precise analytical data in a timely manner. The work of these laboratories in detecting threats is strengthened by their membership in networks such as the LRN. Most tests a PHL performs are not reported in the media: they work behind the scenes to analyze threats of suspicious packages and intentionally-contaminated foods.

For example, in FY13, PHLs tested over 4,000 samples for various threat agents. These laboratories also tested over 150,000 samples in support of the BioWatch Program overseen by the Department of Homeland Security (DHS). The BioWatch Program has a series of pathogen detectors which collect airborne particles onto filters and are transported to laboratories for analysis. The program aims to provide early warning of a pathogen release. Of the 4,000 samples analyzed for threat agents, PHLs tested over 1,200 letters, including 500 letters containing suspicious powders, food items and other substances. The political implications of terrorism threats by white powders and suspicious packages are significant. From Maryland to Puerto Rico, laboratories shared countless stories of their efforts in working with first responders and the FBI to confirm and or rule-out threats in “white powders” sent to high-ranking officials.

Los Angeles County PHL Detects Plague

In July 2013, the Los Angeles County PHL detected plague in a ground squirrel. Due to their membership in the LRN, which includes access to standardized testing procedures, the laboratory was able to quickly identify and confirm this disease and collaborate with epidemiologists and law enforcement to rule-out a bioterrorism event. By engaging all partners from environmental health, law enforcement, Vector Control, US Forest Service and the public information officer, the lab contributed to the prompt closure of park campgrounds which prevented additional cases and the spread of plague in LA County.



As significant as the testing of suspicious substances is, the work done by PHLs to detect foodborne pathogens is just as important. Robert Barnes, scientist at the Virginia Division of Consolidated Laboratory Services (DCLS), analyzes a DNA fingerprint of a bacterial isolate subtyped via Pulse-Field Gel Electrophoresis (PFGE). PFGE is a valuable tool in identifying causation during national foodborne outbreaks and helps epidemiologists and laboratory scientists to ascertain where the source of the outbreak or contaminated food originated.



A ground squirrel similar to the one confirmed to have plague in LA County

West Virginia Detects Drinking Water Threats

On January 9, 2014, a noon story on the radio stated the West Virginia Department of Environmental Protection (WVDEP), Division of Air Quality was investigating complaints of an odd odor. Listeners probably thought little of this brief story since there are several chemical plants in Kanawha County and odd odors come and go. In fact, later in the afternoon, the source was found to be a leaking tank at Freedom Industries on the bank of the Elk River. The leak was large enough that the chemical, 4-methylcyclohexanemethanol, saturated the filters of the West Virginia American Water Company plant 1.5 miles downriver. Governor Tomblin announced on the 6:00 pm local news a “do not use” order for all customers of West Virginia-American Water Company explaining what had happened. The spill affected approximately 300,000 customers in nine counties in southern West Virginia.

At 9:45 pm, the National Guard established an Incident Command System and planned to work with the water company to set up and control sample collection as well as analysis tracking. Due to the turn-around time requirements, the Office of Laboratory Services reported one sample every 19 minutes during the first nine days of the incident. Sample priorities changed hourly in the first week to assure whole zones were back online in the shortest, yet safest amount of time. Reporting was split between emailing and texting the operations officer stationed at incident command.

The LRN-C laboratory only has two staff members so staff from other sections helped meet the need for 24/7 operation. Fifty days after the first radio story, the governor declared the end of the drinking water emergency incident. The incident lasted over 30 days for the PHL with the LRN-C and drinking water personnel testing 581 of the over 3,000 samples. Personnel worked 174 hours overtime in January and early February.

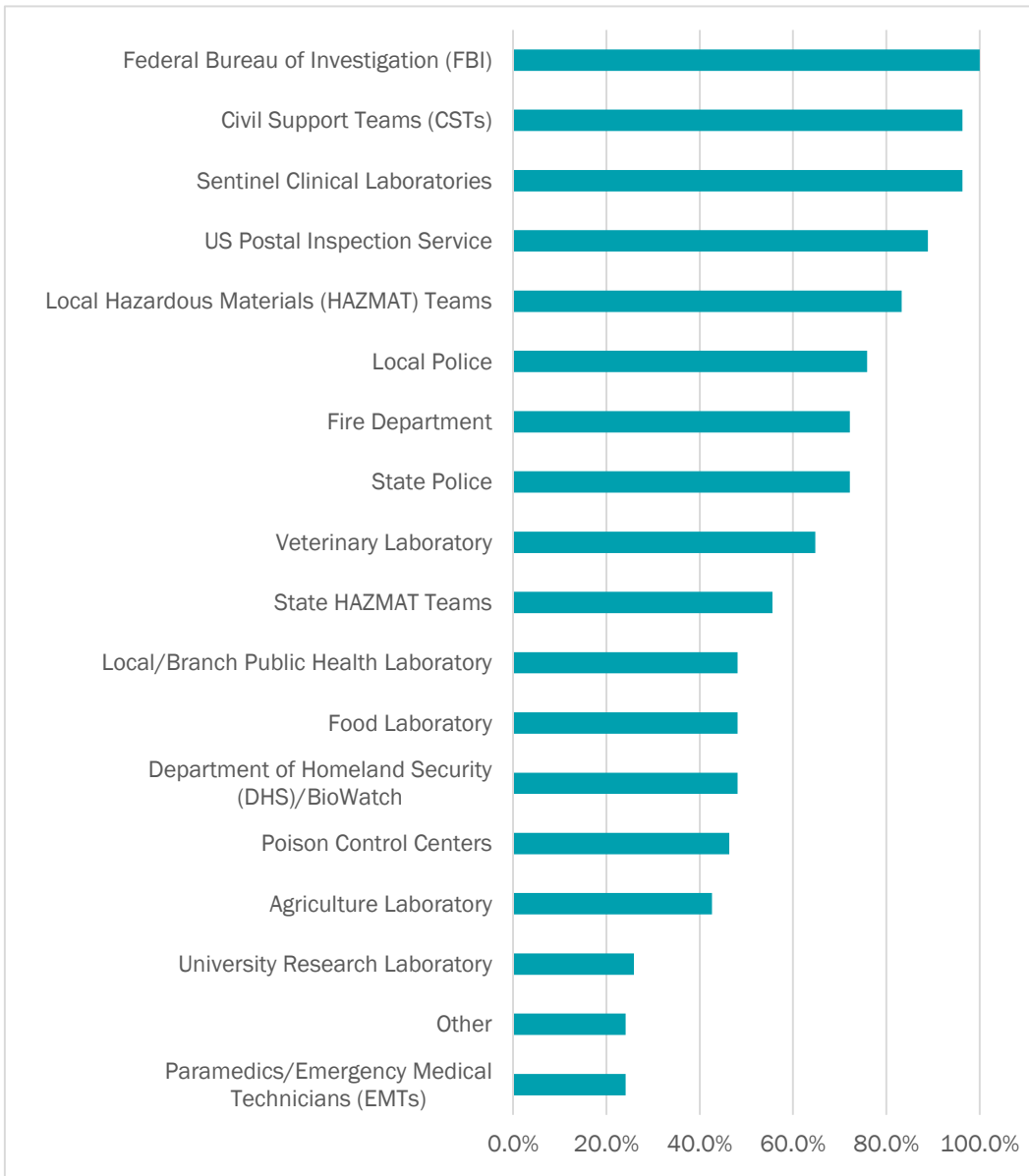
Without the personnel, training, instrumentation and supplies provided for by the PHEP Cooperative Agreement, the drinking water disaster could not have been addressed by the West Virginia Office of Laboratory Services. Commercial laboratories, while an important asset, are not always readily available nor can they be quickly accessed during the early hours of an emergency. In addition, WV's LRN-C laboratory adapted a CDC method that allowed them to report results three times faster than the other responding laboratories.

Without the personnel, training, instrumentation and supplies provided for by the PHEP Cooperative Agreement, the drinking water disaster could not have been addressed by the West Virginia Office of Laboratory Services.

Respond

PHLs are on the frontlines working collaboratively with many partners — epidemiologists, clinical laboratorians, first responders and health officials — to respond to all threats. Whether dealing with infectious diseases or environmental hazards, PHLs work to identify the threat agent and relay that information to guide local response efforts. Many agencies submit samples to PHLs and rely on their expertise to assist with rapid response to various threats. Figure 8 provides a snapshot of agencies that submitted samples to PHLs in FY13.

Figure 8: Agencies that PHLs Collaborate with on Sample Submission



A hallmark of the PHL system is the strong partnerships to respond to all threats, whether manmade or natural disaster. The Colorado Department of Public Health and Environmental Laboratory was an invaluable resource to the residents of Colorado during the flooding in the summer months of 2013, assuring that food supplies and drinking water were safe.



Responding to Natural Disasters in Colorado

Colorado saw some of the worst flooding on record during August and September of 2013. Parts of the state were declared disaster areas and recovery was still ongoing in June 2014. The flooding experience within the state affected public health, food supplies and potable water. The Colorado Department of Public Health and Environment Laboratory Services Division was a significant contributor to the emergency response and continued to provide essential services during recovery. One component of the early phase response was priority testing of municipal water systems and private wells in affected areas. Over a two week period, staff performed 1,236 tests in impacted areas; over the course of a month 2,380 tests were performed. Proving the dedication of the laboratory staff, most of this testing was performed over three consecutive six-day work weeks. A statewide courier service, maintained with PHEP funds, provided scheduled and *ad hoc* sample pick-up and a reverse-courier function to deliver laboratory sample collection supplies to impacted areas. Using PHEP funding, the laboratory implemented an extensive cross-training plan that increased staff capability three-fold, especially in the area of molecular-based testing. The laboratory maintained testing turn-around times throughout the response, owing to the capabilities of broadly-trained staff and the capacity afforded by high-throughput instrumentation maintained using PHEP resources. The PHL provided critical services to assist with the response to this natural disaster.



Laboratorians conduct water testing inside the Colorado Chemistry Laboratory.

Washington State Responds to Potential Radiation Threat

Imagine finding out that your child plays soccer on a field adjacent to radioactive buildings. This happened to parents in Seattle whose children play on a tract of lakefront land that, during World War II, was used for naval training duties.

Following the war, the land was donated to the City of Seattle, which converted it to a children's soccer field. Recently it was divulged by a Seattle City worker, performing due diligence after the land transfer from the Navy to the City of Seattle, that the buildings on the property were also used by the Navy to repair and repaint radium dials for aircraft during the war and, as such, were emitting a low level of radiation to anyone present in the vicinity, including the children who visited the area to play soccer. Although contamination was below levels that affect health, given the vulnerable population exposed, the Navy undertook cleanup of any remaining areas with radium emissions above background.

The Washington Department of Health Public Health Laboratories, Office of Environmental Laboratory Sciences, Radiation Laboratory, performed rapid turnaround radium emissions testing on soil and air filter samples during the cleanup in order to minimize potential hazard to park neighbors and users. Rapid screening for Ra-226 was performed by gamma spectrometry, with confirmation of samples above action levels by a full alpha spectrometric analysis. The most recent samples taken from this site have been within the Naturally Occurring Radioactive Materials (NORM) range for Radium-226.



While the radiation work of the Washington laboratory was not supported directly by PHEP funding, it serves as an important reminder that radiation preparedness remains a large gap in this country.

Virginia Responds to Possible Tularemia and Hantavirus

The Virginia Division of Consolidated Laboratory Services (DCLS), VA's state PHL, was involved in responding to a suspicious cluster of illness and deaths in a family presenting with symptoms consistent with tularemia and hantavirus infections. It is not every day that a physician reaches out to a local public health laboratory to request testing to rule-out diseases long thought to be eradicated from the US. Due to the strong partnerships and collaboration with their local FBI, sentinel laboratory, Office of the Chief Medical Examiner and various other state and federal agencies, the VA DCLS staff were able to acquire a courier to deliver samples to the laboratory. Within hours, they were able to rule-out *Francisella tularensis* (tularemia) and hantaviruses in this unusual cluster. The VA DCLS confirmed that the cluster was not related to either of these high-consequence organisms. Although this particular cluster of illness was not due to tularemia or hantavirus, had the samples been positive, they would have needed a full and rapid response effort by all state, local and federal partners. DCLS demonstrated that the trainings and capabilities provided by their participation in the LRN were effective tools to respond to this potential threat and provide high confidence results to reassure their partners.



DCLS LRN-Molecular Scientist Asia Bey prepares to setup the MagNA Compact nucleic acid extraction platform for testing in the BT-Bacti Environmental BSL-3 laboratory. The Compact is used routinely for "white" powders, threat letters and MERS-CoV testing at DCLS.



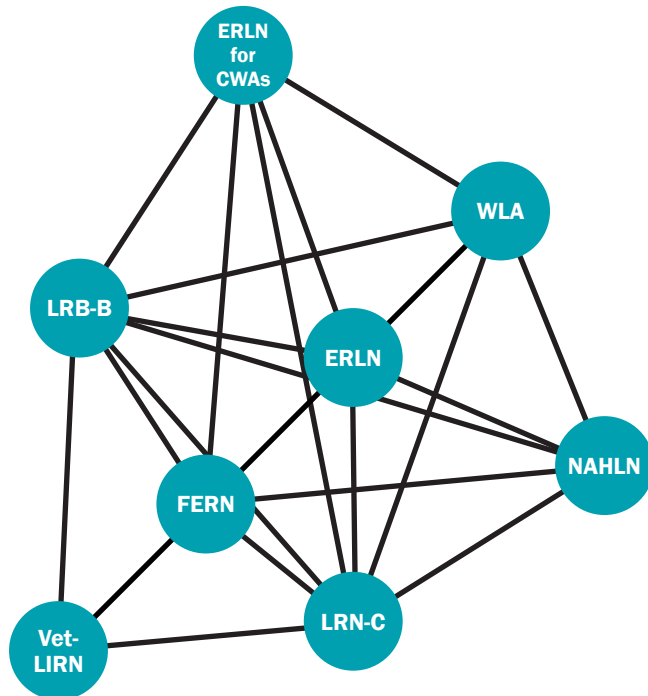
DCLS LRN-Microbiologist Senior Scientist Susan Liegey subcultures broth cultures to solid media for biothreat rule-out testing in the BT-Bacti Clinical BSL-3 laboratory at DCLS.

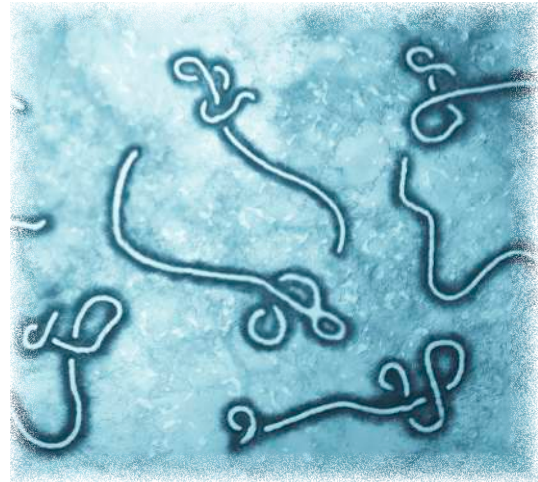


DCLS Pulse-Field Gel Electrophoresis (PFGE) senior scientist, Francis Tannor, operates one of several Chef Mapper instruments used in PFGE subtyping analysis of bacterial isolates at DCLS.

In addition to their participation in the LRN, PHLs participate in many networks such as the Environmental Response Laboratory Network (ERLN) including the Water Laboratory Alliance (WLA), Food Emergency Response Network (FERN), and the National Animal Health Laboratory Network (NAHLN). These networks, primarily supported by federal agencies, rely heavily on state and local governmental laboratories to detect and respond to all-hazard threats.

Figure 9: PHLs Participate in Multiple Networks





Conclusion

PHLs serve as a vital component of the nation's health security. These laboratories continue to improve their practices and evolve to meet the new demands of laboratory testing while dealing with the constant struggle of diminished resources. In a rapidly evolving world of increased global travel, threats increase exponentially and preparedness for the defense of public health and safety will be diminished without sustained resources. This report highlights that PHLs are excellent stewards of resources supporting responses to all-hazard threats.

In addition to demonstrating the enormity of the progress and significance of the contributions made since the inception of preparedness funding, this report casts a spotlight on the remaining needs of the PHL system. Data points presented in this report recognize advancements in preparing, detecting and responding to threats. However, many issues go unaddressed; among the more serious are funding shortfalls, gaps in radiological testing capability and capacity, and a continued scarcity of qualified laboratory workforce members.

In the absence of sustained federal funding, PHLs will face significant hurdles to recruit and retain skilled personnel, procure and maintain new technologies, and train partners, including performing outreach to sentinel clinical laboratories. APHL continues to advocate for resources to PHLs, which are the first line of defense against emerging threats. Creating a lasting culture of preparedness is not a one-time goal. Funding support must instead be constant and designed to evolve in tandem with the ever-changing needs and untold hazards encountered daily by the US laboratory system.

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Association of Public Health Laboratories

The Association of Public Health Laboratories (APHL) is a national nonprofit dedicated to working with members to strengthen laboratories with a public health mandate. By promoting effective programs and public policy, APHL strives to provide public health laboratories with the resources and infrastructure needed to protect the health of US residents and to prevent and control disease globally.



8515 Georgia Avenue, Suite 700
Silver Spring, MD 20910
Phone: 240.485.2745
Fax: 240.485.2700
Web: www.aphl.org