Chemical, Biological, Radiological and Nuclear Consequence Management Advisory Division

2015 ANNUAL REPORT

As fiscal year 2015 (FY15) ends, it is my pleasure to once again highlight activities performed by our Consequence Management Advisory Division (CMAD). An evolving theme we have been focusing on since the beginning of my tenure in 2011 is collaboration. Based on my review of annual reports from previous years, it is apparent that we are realizing returns on our historical efforts and investments. CMAD's response activities in FY15 have been unprecedented, distinguished by the number of requests from federal, state, city, and tribal agencies for CMAD assistance. This year's Annual Report discusses projects, field studies, and responses that exemplify our partnerships with U.S. Environmental Protection Agency (EPA) Regions; the National Homeland Security Research Center (NHSRC); other Special Teams; and key federal agencies such as the Department of Homeland Security (DHS), the Centers for Disease Prevention and Control (CDC), and the U.S. Department of Defense (DoD).

National and world events in FY15 unexpectedly renewed focus and attention on the biological arena. Using our subject matter expertise, we worked with many partners by providing technical support to the Ebola response decontamination planning and preparation efforts; the ricin responses in Regions 5 and 6; the *Burkholderia pseudomallei* response in Region 6 at the Tulane National Primate Research Center; and the DoD anthrax laboratory response, which affected every Region and five countries and required working closely with the CDC, NHSRC, and the EPA Office of Chemical Safety and Pollution Prevention (OCSPP).

CMAD and NHSRC have secured funding from DHS for the Underground Transport Restoration Project to support our co-leadership during this multi-year effort to deliver federal guidance that decreases the time required to return a subway system back to service after a biological incident. DHS also has provided funding for developing a radiation decontamination application (Rad Decon App) to be released next fiscal year. This year, we also increased our participation with the Federal Emergency Management Agency (FEMA) Nuclear Incident Response Team (NIRT), which resulted in us working closely with the Office of Radiation and Indoor Air (ORIA) and the U.S. Department of Energy (DOE) to improve federal response to radiation incidents. We partnered with the New York City (NYC) Department of Health and Mental Hygiene to develop a wide-area biological tactical response plan that we intend to modify in the future to apply to cities nationwide. In addition, during FY15, we supported a variety of regional exercises and training sessions as discussed in this year's Annual Report. For many of our projects, we identified opportunities to invite other teams to join us in carrying out our mission, including the EPA's Environmental Response Team (ERT), the Radiological Emergency Response Team (RERT), the National Counterterrorism Evidence Response Team (NCERT), and On-Scene Coordinators (OSC). We also engaged a number of OSCs to help develop Chemical, Biological, Radiological, and Nuclear (CBRN) Training, which will be offered at the 2016 OSC Academy.

I am extraordinarily proud of CMAD's mobile assets, which have provided cost and time savings to the Regions. The Airborne Spectral Photometric Environmental Collection Technology (ASPECT) aircraft has been deployed many times this year, including to the Tronox Mines Site in Region 9, where ASPECT was able to provide the technology for surveying a large area of mountains and canyons that typical ground technologies are unable to survey. The Portable High Throughput Integrated Laboratory Identification System (PHILIS) has supported efforts at many sites, field studies, and events this year, most notably when PHILIS was used to provide a high-volume, fast-turnaround analysis for the Coppola Metals Site in Region 1 over the Christmas holiday, resulting in both cost savings and flexibility.

Lastly, we are fortunate that our staff continues to grow in support of our critical missions of response, research, and training. I am proud to announce the hiring of former Region 3 OSC, Francisco J. Cruz, and a former NHSRC scientist, Dr. Shannon Serre, and welcome them to our ranks. We also soon will hire a chemist to augment our staff with additional expertise.

It is exciting to see the hard work and dedication of CMAD staff truly pay off in partnerships that not only supplement our budget but also allow us to engage in scientific collaboration with other organizations, thereby accomplishing more than we could alone. This letter highlights only a few examples of CMAD's work, and I hope you have time to read through this year's Annual Report for more details. We are proud to be in a position to support such a vast array of efforts and look forward to continuing to foster collaboration!

Sincerely,

Erica Canzler


190
Number of personnel CMAD trained in Ebola personnel decontamination procedures
6,000
Number of miles the PHILIS Laboratory Unit (the bus) traveled in 2015
1,300
Generic cost in dollars per ASPECT flight hour to our customers
3,875
Linear miles surveyed by ASPECT aircraft in FY15
3
Number of Professional Engineers on staff
6
Number of locations where CMAD members are stationed throughout the U.S.
255
Years of collective EPA experience of CMAD's members (400 years of relative experience including non-EPA jobs)
33
Percent of CMAD team members who were once OSCs
2
Maximum number of hours for PHILIS to hit the road to mobilize to a site from time of request
60
Minutes to wheels-up upon ASPECT activation

I. RESPONSE DEPLOYMENTS, TECHNICAL ASSISTANCE, AND FIELD STUDIES

II. TRAINING AND EXERCISES

III. TECHNOLOGY AND LIVE DEMONSTRATIONS

IV. COLLABORATION

V. ACRONYMS AND ABBREVIATIONS

Burkholderia pseudomallei Sampling Assistance at Tulane National Primate Research Center (TNPRC)

In late November 2014, two non-human primates became ill in the breeding colony at the TNPRC, a private research facility. In mid-December 2014, the Centers for Disease Control and Prevention (CDC) analyzed samples and identified *Burkholderia pseudomallei* as the cause of illness. This strain of bacteria is not endemic in the United States but was the subject of research at the TNPRC.

Contractors sampling in the wetland area in TNPRC.

Because *Burkholderia pseudomallei* is both a Federal Select Agent and a Category B Agent and the material was considered contained, the CDC and U.S. Department of Agriculture (USDA) initiated an investigation, with assistance from other federal agencies. As part of the initial investigation in January 2015, federal and state scientists visited the TNPRC to conduct epidemiological studies, review laboratory practices to determine possible routes of transmission, and sample the breeding colony areas that housed the two ill non-human primates.

In February 2015, CDC (the lead federal agency for the response) requested that the U.S. Environmental Protection Agency (EPA) develop a targeted sampling plan to determine if *Burkholderia pseudomallei* had been released into the environment from the two ill non-human primates. The EPA Consequence Management Advisory Division (CMAD) and a Region 6 On-Scene Coordinator (OSC) developed a sampling plan implemented by Tulane staff resulting in the collection of 42 samples from inside the breeding pens, 15 water

The Federal Select Agent Program is jointly composed of the CDC's Division of Select Agents and Toxins and the Animal and Plant Health Inspection Services (APHIS)/ Agriculture Select Agent Services. The Federal Select Agent Program oversees the possession, use, and transfer of biological Select Agents and Toxins, which have the potential to pose a severe threat to public, animal, or plant health or to animal or plant products. For more information, visit the Federal Select Agent Program website at http://www.selectagents.gov/

Definition of CDC Bioterrorism Agent Categories

Category A	Category B	Category C
• Pose the highest risk to national security • Can be easily disseminated or transmitted from person to person • Result in high mortality rates • Require special preparedness actions • Have the potential to cause public panic and social disruption	• Pose the second highest risk to national security • Are moderately easy to disseminate • Result in low mortality rates • Require enhancement of diagnostic and surveillance capability	• Emerging pathogens that could be engineered for mass dissemination • Are easily produced and disseminated • Have the potential for high mortality rates • Are available

samples from ditches collecting runoff from the pens and from a downstream wetland (which also received effluent from the wastewater treatment plant), 12 bulk air samples, and 12 samples from vehicles used to transport non-human primates between the breeding colony and laboratory portions of the TNPRC.

Concurrently as the environmental samples were being collected, CMAD and the National Homeland Security Research Center (NHSRC) evaluated decontamination strategies for the non-primate pens in the breeding colony in case the decision was made by the Unified Command to decontaminate these outdoor areas. Techniques evaluated included methyl bromide soil fumigation, excavation, treatment and disposal, and *in situ* chemical oxidation using sodium persulfate (Klozur® FMC).

Based on the limited targeted sampling of the breeding colony area, rather than implement a decontamination technology, the Unified Command decided to conduct additional soil sampling. In April 2015, an additional 600 soil samples were collected in and around the pens of the two initially ill primates. Results based on three testing methods yielded no positive results for *Burkholderia pseudomallei*.

On the TNPRC grounds and adjacent properties, state and federal officials collected wildlife samples from 143 animals, including feral cats, rats, opossums, armadillos, nutria, and raccoons. All results have been negative for *Burkholderia pseudomallei*.

The CDC's epidemiological investigation resulted in the testing of 31.2% of all the 4,107 animals in the TNPRC. To date, seven non-human primates have been euthanized because they tested positive for *Burkholderia pseudomallei*.

Ultimately, based on the CDC's investigation of the exposure incident in November 2014, results for environmental samples collected in February and April 2015, and the continued sampling of non-human primates and wildlife, the Unified Command decided not to decontaminate any portions of the TNPRC. Monitoring of non-human primates and wildlife will continue, and if the situation changes, EPA and CMAD are available to provide additional support.

***Burkholderia pseudomallei*, a saprophytic gram-negative bacillus, is the causative agent of melioidosis. The bacteria are found in soil and water and are widely distributed in tropical and subtropical countries. Transmission may occur via subcutaneous inoculation, ingestion, or inhalation. Person-to-person transmission is extremely rare but may occur through contact with the blood or body fluids of an infected person. The incubation period generally is 1 to 21 days but may extend for months or years. With a high inoculum dose, symptoms can develop in a few hours. Melioidosis may occur as a subclinical infection, localized infection (such as cutaneous abscess), pneumonia, meningoencephalitis, sepsis, or chronic suppurative infection. The latter may mimic tuberculosis, with fever, weight loss, productive cough, and upper lobe infiltrate, with or without cavitation. More than 50% of melioidosis cases are present with pneumonia.**

CDC Bioterrorism Diseases/Agents	
Category A Diseases/Agents	
• Anthrax (*Bacillus anthracis*) • Plague (*Yersinia pestis*) • Tularemia (*Francisella tularensis*) • Botulism (*Clostridium botulinum* toxin)	• Smallpox (*Variola major*) • Viral hemorrhagic fevers (filoviruses such as Ebola and Marburg and arenaviruses such as Lassa and Machupo)
Category B Diseases/Agents	
• Brucellosis (*Brucella* species) • Food safety threats (such as *Salmonella* species, *Escherichia coli* O157:H7, and *Shigella*) • Melioidosis (*Burkholderia pseudomallei*) • Q fever (*Coxiella burnetii*) • Staphylococcal enterotoxin B • Viral encephalitis (alphaviruses such as Venezuelan, eastern, and western equine encephalitis)	• Epsilon toxin of *Clostridium perfringens* • Glanders (*Burkholderia mallei*) • Psittacosis (*Chlamydia psittaci*) • Ricin toxin from *Ricinus communis* (castor beans) • Typhus fever (*Rickettsia prowazekii*) • Water safety threats (such as *Vibrio cholera* and *Cryptosporidium parvum*)
Category C Diseases/Agents	
• Emerging infectious diseases such as Nipah virus and hantavirus	

Ricin Analytical Support for Incidents in Wisconsin and Oklahoma

CMAD's 2014 Annual Report highlighted our involvement in several ricin incidents. In response to these incidents, CMAD provided ricin training in several Regions as well as to EPA's National Counterterrorism Evidence Response Team (NCERT), focusing on statutory and regulatory authorities, characterization and clearance sampling strategies, and analytical options for ricin analysis.

In addition to providing support during the Oklahoma ricin incident in January 2015, CMAD provided support during the Wisconsin ricin incident in December 2014. These responses stressed ongoing challenges related to analytical support for ricin incidents. Unique analytical strategies and methodologies were required for the characterization and clearance phases of both responses. Responders relied on a tiered approach based on site-specific information, lines of evidence, and analytical assets to overcome characterization and clearance challenges. Unique aspects of ricin responses are summarized below.

Responders prepare for entry into ricin contaminated building.

Characterization Approaches

For both the Oklahoma and Wisconsin incidents, site-specific information was obtained from the Federal Bureau of Investigation (FBI) as it evaluated a nexus of potential terrorism activity. Additionally, the FBI provided preliminary analytical information from its screening efforts using handheld assay instruments in the affected homes. For characterization, polymerase chain reaction (PCR) technology was available from the FBI's Quantico laboratory and the local National Guard Civil Support Team (CST) mobile laboratory.

The characterization approaches typically focused on the determining presence of ricin for law enforcement purposes and did not include the objective of determining the extent of contamination.

Unavailability of PCR Analysis

Currently, the CDC no longer provides the reagents necessary for conducting PCR analysis to state public health laboratories. The only option currently available for conducting PCR analysis is to contact and request the use of CST mobile laboratories.

PCR analysis evaluates for two ribosome-inactivating protein chains: Chain A and Chain B. Chain A is responsible for inhibiting protein synthesis in cells, and Chain B allows ricin to enter cells. Both Chain A and B must be present for ricin to be toxic.

Decontamination

Because of the uncertainty and unavailability of characterization sampling, the decision was made for both ricin responses to proceed directly to decontamination using a bleach solution. Bleach solution has proven effective in inactivating ricin and is an accepted decontamination tactic. Proceeding directly to decontamination alleviated the need to conduct characterization sampling and the uncertainty of determining the extent of contamination based on limited analytical procedures.

Sampling of suspected ricin contamination area.

Clearance Sampling

Proceeding directly to decontamination using a bleach solution limits analytical options for clearance sampling. The tiered list below summarizes analytical options in priority order and relevant considerations.

1. Electrochemical Luminescence (ECL)
   - ECL is available from all CST mobile laboratories.
   - CST has indicated that ECL is not impacted by bleach (possibly due to different reagents used by the U.S. Department of Defense (DoD) and the CDC).
   - Extensive coordination is required between the responders and the CST to facilitate ECL analysis using the CST mobile laboratory.
2. Time-Resolved Fluorescence Immunoassay (TRFIA)
   - TRFIA is available at some laboratories in the Laboratory Response Network (LRN).
   - Bleach interferes with TRFIA.
   - TRFIA may be best used for sampling the outer perimeter of the decontaminated area.
3. Ricin Component Multiplex Assay (RCMA)
   - RCMA is available only at the CDC.
   - RCMA is difficult to access.
4. Ricin Mass Spectrometry Activity Assay (RMSAA)
   - RMSAA is available only at the CDC National Center for Environmental Health.
   - RMSAA is difficult to access.
5. Matrix-Assisted Laser Desorption Ionization Mass Spectrometry (MALDIMS)
   - MALDIMS currently is under development by the CDC for use at LRN laboratories.

CMAD personnel supporting ricin sampling.

Ongoing Efforts for Ricin Analysis

EPA's Office of Emergency Management (OEM)/CMAD currently is working on agreements with the DoD for accessing the DoD laboratory network and reagent and assay capabilities. The agreements will provide responders with access to ECL analysis options shown to be effective for clearance sampling.

Additionally, the EPA Office of Research and Development (ORD) NHSRC and OEM/CMAD are working on further TRFIA method development with the Lawrence Livermore National Laboratory to resolve bleach interference issues. Depending on the outcome of this effort, TRFIA analysis may be more easily available in the future.

EPA also is discussing with the CDC options for accessing CDC sources for ricin analysis that currently are unavailable.

Response to a Ricin Incident

Because of the lack of clarity regarding analytical options for ricin analysis, responders should call the EPA CMAD for information on the current status of all available analytical options.

PCR sampling strips.

Response Support at Laboratories that Received Live Anthrax Specimens

During Memorial Day weekend in 2015, the CDC contacted the EPA CMAD and ORD NHSRC requesting consultation for decontamination strategies and tactics for 11 commercial laboratories in seven states. The laboratories were believed to have received anthrax specimens that were not appropriately inactivated from the DoD's Dugway Proving Grounds (DPG).

As part of a contract bid, DPG sent specimens of what was thought to be irradiated anthrax specimens to 11 laboratories. Some of the specimens were shipped without a death certificate that officially documents the inactivation of the specimens. As part of its standard operating procedure (SOP), one of the laboratories cultured the specimen to ensure that it was inactivated. The culture showed viable colonies of anthrax in the specimens, initiating a wider investigation into the inactivation practices of DPG and the possibility of other laboratories having received live anthrax specimens. Many of the laboratories receiving the samples were designed as Biosafety Level (BSL) 2 laboratories, but live anthrax must be handled by a BSL 3 or higher laboratory. Therefore, improper handling posed an anthrax exposure risk to laboratory workers.

After the laboratory identified viable anthrax specimens, state health departments, the CDC, and the DoD were notified. The CDC requested support from EPA on providing decontamination guidance to the laboratories. Most issues were related to guidance on decontaminating BSL 2 laboratories, electronics, and porous and nonporous surfaces. The CDC was the lead agency for the incident based on its role with the Federal Select Agents Program, which is responsible for the handling of Federal Select Agents within a laboratory environment.

The initial response focused on the following two priorities:

1. Evaluating risks to the laboratory worker and the need to provide medical countermeasures for individuals considered at risk
   - Four individuals in the United States required pre-exposure prophylaxis.
   - Twenty-two people in South Korea required pre-exposure prophylaxis.
2. Securing all the samples sent by DPG, and having the CDC culture these samples to determine the viability of the anthrax in the samples

Concurrently, the CMAD and CDC initiated the development of decontamination strategies. The CMAD coordinated with EPA's Office of Chemical Safety and Pollution Prevention (OCSPP) to expedite Section 18 exemptions required for some products not officially registered for use against anthrax but that could provide quick, safe, and effective decontamination of anthrax.

Decontamination team preparing to enter a lab that received Bacillus anthracis spores.

To expedite information sharing and document review, EPA sent subject matter experts (SME) from CMAD and NHSRC to CDC's Emergency Operations Center in Atlanta. The SMEs were able to assist the laboratories and state health departments troubleshoot decontamination issues and answered questions regarding joint CDC/EPA decontamination recommendations.

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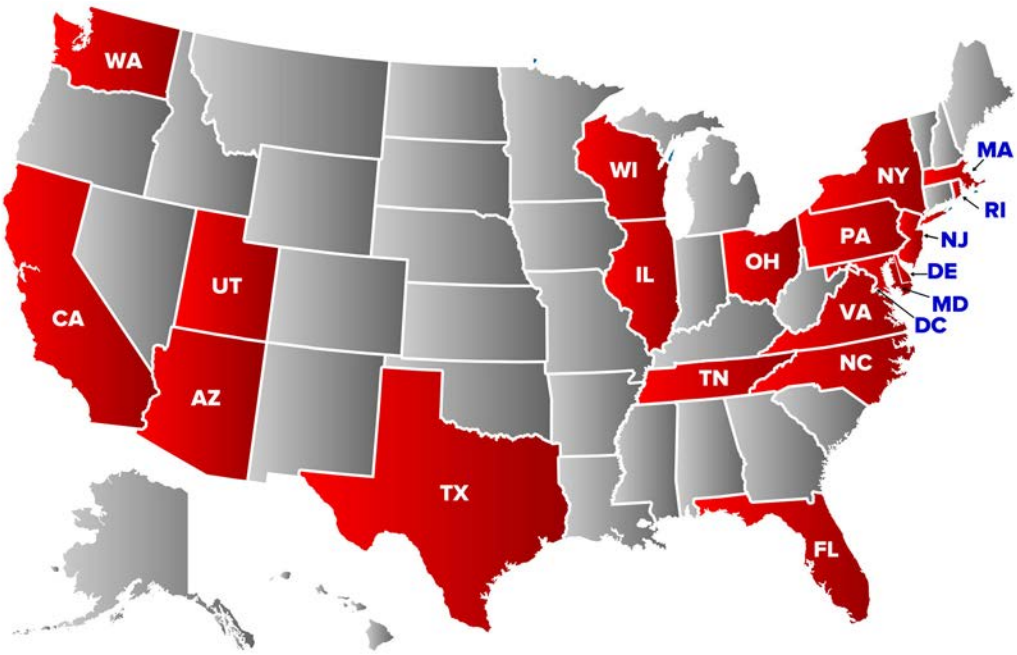
Number of consultations where EPA provided technical support to states and impacted laboratories receiving anthrax deliveries (MD, DE, NJ, TN, CA, TX, WI, UT, and NY)



Map of U.S. States where viable Bacillus anthracis packages were found (impacted states in red).

This incident was highlighted in the national media for several days and garnered the attention of the Secretary of the Defense Department and the White House.

Thanks to the collaboration between the CMAD, NHSRC, and CDC, consensus-driven recommendations based on the best science available were generated to provide the affected laboratories with the information needed to protect their workers and safely reopen the laboratories.

During the subsequent investigations, DoD identified additional sample lots from DPG on which the same ineffective methods of inactivation were used as the specimens sent to the 11 laboratories. Ultimately, 45 civilian and 18 military laboratories in the United States were identified as possibly receiving viable anthrax specimens. A total of 69 laboratories worldwide possibly received viable anthrax specimens in 20 states (including the District of Columbia) and 6 countries.

Lab that received anthrax sample prior to decontamination.

Highly Pathogenic Avian Influenza Technical Support to USDA

Newly emerged highly pathogenic avian influenza viruses have caused outbreaks among poultry populations in the United States. The outbreaks began in December 2014 and peaked in May 2015, with 21 states affected and over 50 million birds euthanized. The CMAD, in cooperation with the NHSRC and OCSPP, provided technical support to the USDA Animal and Plant Health Inspection Service (APHIS) in an advisory role to help mitigate the effects of the outbreaks.

Poultry.

Photo credit: Diane Vatcher

Options for cleaning the impacted facilities included heat treatment, liquid surface decontamination options, and fumigation. A major concern was damage to electronic heating and ventilation control systems in the poultry shelters. These control systems could have been damaged by liquids and oxidizing agents such as chlorine dioxide.

EPA provided guidance based on its experience, including options for inactivating biological agents and guidance regarding material compatibility issues. The CMAD and NHSRC also participated in calls discussing disposal options for the euthanized birds. The CMAD remains on stand-by status in case the USDA requests additional assistance.

50,000,000

Number of birds euthanized due to avian influenza outbreak in U.S.

Study of the Use of Methyl Bromide to Inactivate *Bacillus anthracis* Spores

Shooting methyl bromide into a contained rail car at night.

As part of the Underground Transport Restoration Project, the Chemical, Biological, Radiological, and Nuclear (CBRN) CMAD, in collaboration with EPA's Environmental Response Team (ERT) and ORD, recently completed a study to evaluate the decontamination of a subway car using methyl bromide. The study was a joint project with the Department of Homeland Security (DHS), Sandia National Laboratories, and Lawrence Livermore National Laboratory. The study was designed to evaluate the operational aspects and efficacy of the use of methyl bromide to inactivate surrogate *Bacillus anthracis* spores in a subway car and was conducted in July 2015 at the Sandia National Laboratory in Livermore, California.

A standard, 1980s-era subway car was selected for testing and enclosed in an ethylene vinyl alcohol tent. Before fumigation, material coupons of aluminum, plastic seat cloth, fiberglass wall paneling, Mylar®, carpet, and rubber flooring were removed from an operational subway car and inoculated with about 1,000,000 colony-forming units of *Bacillus anthracis* Sterne spores and sealed inside Tyvek pouches. The inoculated coupons then were placed in various locations throughout the subway car and exposed to 212 milligrams per liter of methyl bromide for 36 hours at 75 °F, with a relative humidity exceeding 75%. The coupons were placed in hard-to-reach areas, including cabinets having ventilation grills, because these areas are where spores may be deposited during an intentional release. Fans were placed throughout the subway car for mixing and to ensure uniform concentration, temperature, and relative humidity conditions throughout the car. In addition to the coupons placed throughout the car, timed-series coupons were extracted

in a Subway Car

every 6 hours to evaluate inactivation as a function of time. In addition, a New York City (NYC) subway switch box was placed in the car to determine material compatibility issues with the switch box from using methyl bromide.

Rail car material coupons with surrogate spores from left to right: carpet, fiberglass, aluminum, rubber, Mylar, and plastic.

During the fumigation, methyl bromide concentration was monitored in four locations within the enclosure, two inside the car and two outside the car, using a Fumiscope® thermal conductivity detector. Two locations inside the car and two locations outside the car were monitored during fumigation. Perimeter monitoring was conducted outside the tented subway car using MultiRAE Pro detectors at four fixed locations, and two mobile MultiRAE Pro units were used to pinpoint leaks. The monitoring system was connected to ERT's remote sampling system called SNAPPER. If the volatile organic compound (VOC) level exceeded an alarm threshold, SNAPPER collected gas samples in Tedlar bags. The samples were sent to CMAD's Portable High Throughput Integrated Laboratory Identification System (PHILIS) for confirmation that the VOC was indeed methyl bromide. Methyl bromide was detected at low part-per-million (ppm) concentrations at the perimeter monitoring points when the timed-series coupons were extracted from the tented area.

After fumigation, air in the tented area was scrubbed using 1,800 pounds of coconut-based activated carbon to capture the methyl bromide. Scrubbing lasted approximately 5 hours while the methyl bromide concentration inside the tented area was reduced to less than 20 parts per million by volume. After scrubbing, the tent was removed and the subway car was allowed to aerate for an additional 12 hours before the coupons were removed.

The efficacy of the decontamination method will be measured by determining the reduction in active spore populations on rail-car material coupons. Efficacy data from this study is pending, and study results will be presented when available.

The results from this field test will help build the nation's capacity to respond to and recover from a *Bacillus anthracis* release in a subway system. The lessons learned will help reduce the time and costs associated with a *Bacillus anthracis* release, resulting in greater resiliency in response to biological incidents.

Methyl Bromide Fumigation Study

1 Setting up the carbon scrubber with coconut-based activated carbon;

2 ERT sets up perimeter air-monitoring equipment;

3 Taking pre-fumigation wipe samples;

12 PHILIS unit on-site to run air samples to test for methyl bromide;

11 Installing Mylar displacement bladder so less methyl bromide is required during fumigation;

10 Placing time-series coupons in perforated pipe before fumigation begins;

13 Last check of rail car with coupons and HOBOs, Mylar displacement bladders, humidifiers and heaters in place before wrapping the rail car;

14 Wrapping the rail car with an ethylene vinyl alcohol "tent";

15 A professional fumigation company sealing the tent;

24 CMAD personnel inspect the rail car post-fumigation.

23 Post-fumigation wipe-sampling;

22 SO and railcar personnel open locked panels, check for methyl bromide before coupons and HOBOs can be recovered;

4 Carbon scrubbers built and ready to use;

5 Placing coupons and HOBO (Temperature and Relative Humidity data logger) behind sealed electronics panels;

6 Coupons with spores on various materials placed in the rail car before fumigation with a HOBO;

9 Time-series coupons placed on a spring (for stability) to be removed in 2-hour or 6-hour intervals;

8 Placing coupons in exterior locked compartments;

7 Sensitive electronics (a NYC switch box);

16 Fumigation warning stickers placed on all sides of the rail car to inform anyone that methyl bromide is in use and to take all necessary precautions;

17 "Shooting" methyl bromide into the railcar at night;

18 Health and Safety Officer (SO) installs a personal air monitor on CMAD personnel prior to their performing Level B entries to retrieve time-series coupons;

21 Removing the Mylar displacement bladders from the rail car post-fumigation;

20 After the test is completed, and the methyl bromide has been sent through the activated carbon scrubber, personnel check the perimeter to ensure no methyl bromide is detected;

19 CMAD personnel retrieve time-series coupons in Level B;

ASPECT Aircraft Use at Tronox Mines Site, Region 9

In November 2014, a Region 9 OSC was tasked with developing a plan for mapping the nature and extent of contamination at an abandoned uranium mine, the Tronox Mines Site, on Navajo Nation tribal lands. The OSC's thoughts turned toward the Airborne Spectral Photometric Environmental Collection Technology (ASPECT) aircraft. EPA's CBRN CMAD ASPECT aircraft is as unique as the challenges faced by the EPA Region 9 Tribal Lands Cleanup Section.

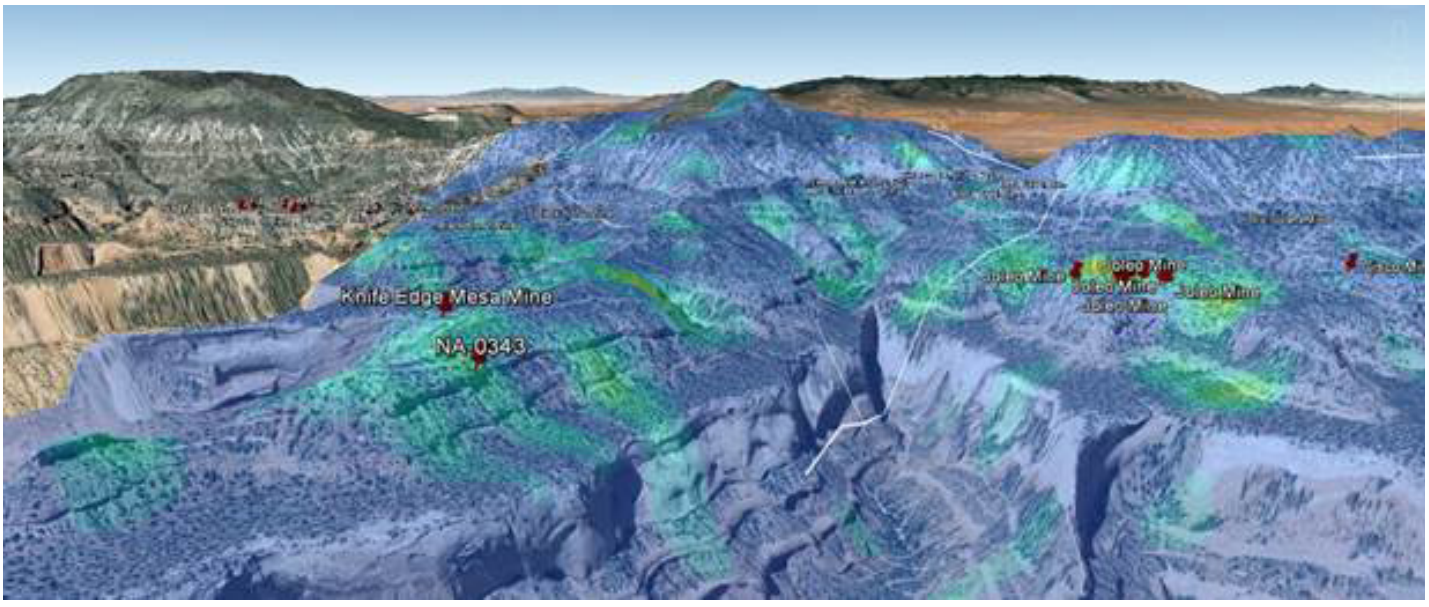
ASPECT aircraft.

The Tronox Mines Site contained 26 confirmed mine claim boundaries and other potential mines. In addition, six additional mines were identified as being site-related. However, actual boundaries had not been clearly identified or delineated for the mines. The project objectives are to determine where the mines are, determine which areas they directly affect, delineate the contamination, and find any undocumented mines.

Although the ASPECT aircraft possesses a wealth of disaster response tools, the most relevant capability for the Tronox Site is its geo-referenced, high-resolution photography coupled with matching radiological information using on-board gamma-ray spectrometer systems.

The ASPECT team finalized a Work Plan in November 2014 and flew the first of two 1-week deployments 1 month later in December 2014. Natural temporal and locational fluctuations in

The EPA ASPECT aircraft provides infrared and photographic images with geospatial, chemical, and radiological information within minutes to hours, depending on the mission.



ASPECT data product illustrating radiological survey and gamma scan results.

background radiation made it necessary to characterize a "calibrated flight line" that ASPECT used to process data and ensure the most accurate readings possible. A typical flight consisted of flying straight flight lines for the radiation surveys or gamma scans as well as random flight lines for high-resolution photographs.

Preliminary images from ASPECT radiological readings over one mine helped strengthen environmental characterization efforts by identifying background radiation locations and elevated radiation locations for follow-up ground-based measurements. These "*in situ* measurements" were used to develop site-specific calibration factors for the ASPECT algorithms and provide actual concentrations of uranium in surface soils. The ASPECT team reached out to another EPA Special Team, the Radiological Emergency Response Team (RERT), to provide the ground-based measurement capability. The National Analytical Radiation Environmental Laboratories joined the ASPECT team in May 2015 to conduct these measurements.

The joint effort provided ground-based measurements, airborne gamma scans, and aerial photographs of the area encompassing the 26 confirmed mines. ASPECT's radiological readings measure surface-soil uranium concentrations to approximately a 1-foot depth. Information from the readings can be layered over a Google Earth image of the area. The ASPECT products in conjunction with the *in situ* data provided by CMAD and the RERT will help determine the mine locations and the precise uranium concentrations. Additionally, the nearly 500 aerial and 500 oblique photographs collected will provide invaluable detail for evaluating terrain and distinguishing between naturally occurring radioactive material (NORM) and technically enhanced NORM. This distinction is important because EPA has jurisdiction only over technically enhanced NORM resulting from mining and milling operations.

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Maximum time in minutes that it takes ASPECT to deliver actionable intelligence to decision makers anywhere in the world

"I knew that in the 1990's, the DOE [Department of Energy] had flown a helicopter with similar technology over the area and that EPA Region 6 had flown an ASPECT mission over the Grants Mineral Belt in New Mexico. The technology was proven and useful, so we wanted to see if we could use it for our work.... It made strategic sense to fly ASPECT over these areas. We wanted to paint the picture and help us prioritize our resources and target list for the years to come. This is the first step in a long process."

OSC Randy Nattis, Region 9

ASPECT and RERT collaborate to provide ground-based measurements.

Restricted area at Tronox site.

PHILIS Use at Coppola Metals Site, Region 1

At the Coppola Metals site in New Haven, Connecticut, the PHILIS mobile asset provided quick and cost-effective analytical support to the Region 1 OSC when a site access dispute was suddenly resolved by a court order allowing sample collection the week before the 2014 Christmas and New Year's holidays. During that time period, PHILIS processed 206 samples for VOCs; 208 samples for semivolatile organic compounds; and 13 samples for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD; also known as "dioxin") at no cost to the Region.

A factor complicating sample analysis was that all the samples were highly contaminated with fuel hydrocarbon. Therefore, most samples required multiple re-extractions, dilutions, and reanalyses. PHILIS met the challenge, and the sample results were delivered electronically to the OSC on a daily basis as SCRIBE-compatible electronic data deliverables. Final data packages were prepared, similar to Contract Laboratory Program deliverables. PHILIS provided timely analytical data on short notice and within the timeframe allotted to support Region 1's site assessment and characterizations goals.

The typical commercial laboratory cost for the project-related quantity of samples with a rapid-turnaround time is approximately $176,000, not counting extra costs incurred due to the many samples requiring re-analysis. PHILIS offered analysis (and re-analysis) at a fraction of this cost without any schedule concerns for the OSC while operating from its base in Edison, NJ, saving mobilization costs as well.

Coppola Metals site.

"With weather, legal and analytical capacity issues, the use of the PHILIS lab was critical to completing this project on time. The project staff were exceptional. They participated in planning meetings prior to site mobilization in order to streamline field collection and sample transfer activities, and they remained available all the way to site close-out. In addition, the analytical team was knowledgeable, flexible, and always willing to help with follow-up questions, clarifications, and report generation."

OSC Marcus Holmes, EPA Region 1


Debris pile at Coppola Metals site.

Field Test of Low-Concentration Hydrogen Peroxide (LCHP) Vapor to Inactivate *Bacillus anthracis* Spores

EPA's NHSRC has laboratory results demonstrating that LCHP vapor, when applied over an extended duration, can effectively inactivate *Bacillus anthracis* spores. To test these laboratory results, CBRN CMAD is partnering with NHSRC and several Region IV OSCs to conduct a full-scale field test. If the study finds that LCHP is effective at inactivating *Bacillus anthracis* spores, the significance of this finding is twofold:

1. The use of LCHP could provide the response community with an increased capacity for addressing and returning properties back to their former uses through the use of commercially and abundantly available off-the-shelf products.
2. The use of hydrogen peroxide instead of more traditional chemical fumigation techniques will greatly reduce health and safety concerns.

Increased Capacity

The projected increased capacity may be realized if LCHP efficacy for inactivating *Bacillus anthracis* can be validated through field testing. A successful test would lead to the development of self-help guidance for home and small business owners, thereby exponentially increasing EPA's response capacity.

Health and Safety Concerns

In addition to increased *Bacillus anthracis* response capacity, if LCHP field application concentrations can duplicate the laboratory hydrogen peroxide concentrations, then health risks will be greatly reduced through the use of hydrogen peroxide instead of traditional fumigation techniques.

The occupational threshold limit value for hydrogen peroxide is 1 ppm in air. The hydrogen peroxide level that is immediately dangerous to life and health is 75 ppm. NHSRC's research shows that as little as 5 ppm of hydrogen peroxide can efficiently inactivate *Bacillus anthracis* when that concentration is held for 7 days. Additionally, NHSRC's research shows that common household room humidifiers can be used as effective hydrogen peroxide vapor generators when concentrations were held for 7 days. Application of this technology and holding the hydrogen peroxide concentration near 5 ppm would significantly reduce the fumigation risk and could allow home and small business owners a solution to *Bacillus anthracis* contamination.

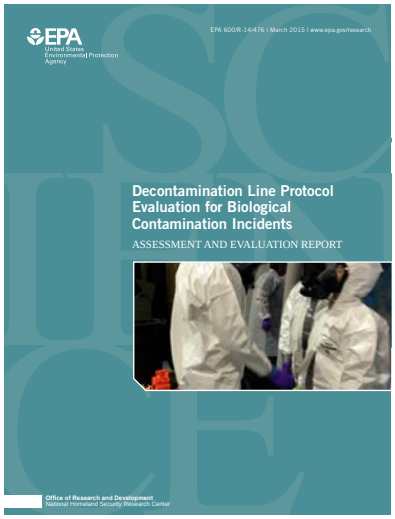
Field test planning began in July 2015, and field testing is just underway as of the publication of this annual report.

Filling a house-hold humidifier with off-the-shelf hydrogen peroxide to inactivate Bacillus anthracis surrogate spores.

CMAD Preparation and Training for Ebola Response

Ebola decontamination line.

During Fall 2014 as the Ebola outbreak was expanding in Africa and the first patient was identified in Texas, CMAD worked closely with the CDC, the National Institute for Occupational Safety and Health (NIOSH), and other EPA offices to develop decontamination strategies, identify appropriate personal protective equipment (PPE), and provide wastewater handling recommendations and waste disposal options and criteria to prepare for the identification of additional Ebola cases in the United States.

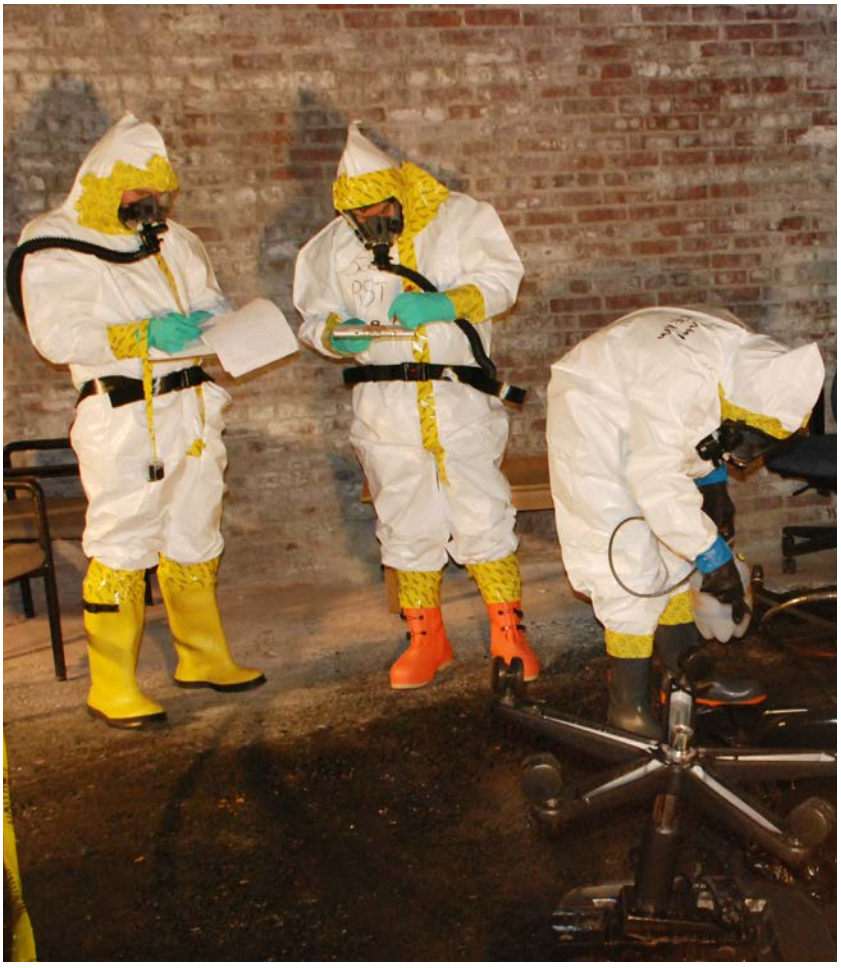


In October, another individual was identified with Ebola outside the healthcare setting. The NYC Department of Health and Mental Hygiene (DOHMH) indicated that assistance from EPA Region 2 may be requested. Region 2 contacted CMAD for assistance in preparing just-in-time training for Region 2 OSCs in anticipation for a possible Ebola response mission.

CMAD, in coordination with CDC and NIOSH, developed the Ebola Clean-up Strategy, PPE and Decontamination Line, and Health and Safety Plan with the support of the ORD NHSRC, ERT, and NCERT. These documents initially were presented to the EPA Federal OSCs during a webinar in November 2014 and then field tested twice in Region 2 in November 2014 and February 2015. After the two field tests in Region 2, the documents were revised based on lessons learned, and then a third field test was conducted in Region 6 in June 2015.

More than 150 people participated in the three field tests, including 50 OSCs from 8 of the 10 Regions. All participants gained a working knowledge of the Ebola Clean-up Strategy, PPE and Decontamination Line, and Health and Safety Plan documents and gained an understanding of tactical issues during a biological response.

Personnel following the Bio Response Decon SOP steps to decon outer suit.



Practicing decontamination of Ebola contaminated chair.

The Level C PPE ensemble for Ebola and other biological responses has been revised to include two hooded suits consisting of an inner Tyvek layer and an outer Saran layer. The preferred respiratory protection is powered air-purifying respirators, but non-powered air-purifying respirators also may be used. The recommendations are based on a PPE study conducted by the NHSRC in September 2014 that identified a significant increase in protection using the two suits (see http://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=307093). Additionally, revisions were made to the Decontamination Line to emphasize a clear demarcation between the "wet" and "dry" sections of the line, eliminating scrubbing during the decontamination process and adding the requirement of a personal shower as the final phase of the process.

ASPECT Aircraft Deployment at 2014 Annual International Balloon Fiesta

The Annual International Balloon Fiesta in Albuquerque, New Mexico, draws hundreds of ballooning teams from all over the world. The multi-day event encourages the paying public to assist teams with the launching and recovery of their balloons. Tens of thousands of people come to the fiesta each day. To catch the optimum wind conditions, most teams and participants arrive at the field before dawn. The participatory nature of the event allows the paying public to roam throughout the venue. This freedom challenges security teams charged with monitoring and responding to potential threats. Rapid screening and evaluation of potential threats is critical. To assist the security teams at the fiesta, CMAD deployed the ASPECT aircraft to the venue to help identify and evaluate potential threats.

Balloons taking flight at 2014 Albuquerque Balloon Fiesta.

The ASPECT aircraft was restricted from operating in the same air space as the balloons. Therefore, the ASPECT team was the first to arrive at the field each day before the night crew had been relieved. Radiological, chemical, and aerial imagery data from each ASPECT flight was delivered to the roaming security teams within minutes of completion of the last flight line. ASPECT's early-morning data collection efforts assured the ground-based monitoring teams that the field was clear of radiological and chemical threats before the arrival of event participants and the public.

Just after noon each day, the ASPECT aircraft screened the area for chemical threats, with the data processed and delivered in the same timeframe as the early-morning data. Because the ASPECT aircraft collected the chemical data from a much higher altitude than the radiological data, the aircraft could be deployed while the balloons were airborne. A Region 6 OSC reviewed all ASPECT data before release to the security teams. This close coordination between federal, state, and local authorities ensured the best possible response to potential threats during the event.

Forward Operating Base at Balloon Fiesta.

A recent focus of the ASPECT program has been the development of automated data processing on board the aircraft and accessibility by satellite communication equipment. The ASPECT system's strength is its ability to rapidly monitor a large area. The ASPECT team worked on developing the on-board algorithms to quickly process the data. The processed data then could be efficiently accessed from the hard drives on the ASPECT aircraft through the satellite communication system.

ASPECT Aircraft Deployment at WINGS Exercise

In addition to supporting EPA's emergency responses, ASPECT also is considered a Nuclear Incident Response Team (NIRT) aerial radiological monitoring asset. The Federal Emergency Management Agency (FEMA) manages the NIRT program, whose mission is to respond during major radiological and nuclear events and provide planning and preparedness exercises for such events. From July 20 through 24, 2015, in conjunction with the national-level exercise "Southern Exposure," the ASPECT aircraft participated in the NIRT-sponsored WINGS exercise in Sumter, South Carolina. The exercise included aerial radiological monitoring assets from the EPA; U.S. Department of Energy (DOE); DoD; Customs and Border Patrol, Florida; Philadelphia, Pennsylvania; and Los Angeles County, California.

WINGS was an interoperability exercise using aerial radiation detection and measuring systems in a real-life, controlled, radiologically contaminated environment. The exercise allowed assets to exercise the NIRT program's Aerial Concept of Operations (CONOPS). The purpose of the exercise was to evaluate the capabilities of aerial assets responding to a radiological emergency, including testing the ability of multiple assets to seamlessly integrate into a unified response.

During the WINGS exercise, the ASPECT aircraft was used to characterize ground-deposited radiation, locate lost radioactive sources, conduct aerial surveys of a nuclear power plant, and map areas of contamination. Of the nine aircraft participating in this exercise, ASPECT was the only asset with the ability to display data in real time and offer quality-assured data products in less than 10 minutes after surveying an area. This capability allows the decision makers in Incident Command to make better and faster decisions during radiological or nuclear events.

EPA and ASPECT appreciate FEMA's efforts in working to build a single federal capability to respond to radiological and nuclear emergencies. The NIRT program's forward-leaning approach maximizes ASPECT program capabilities for providing decision makers the best data in the shortest timeframe. CMAD and ASPECT look forward to future collaborations with FEMA NIRT and other partner organizations, such as DOE and EPA's Office of Radiation and Indoor Air (ORIA).

Interagency collaboration at WINGS 2015.

Radiation Task Force Leader (RTFL) Refresher Courses

During fiscal year 2015 (FY15), CMAD hosted an RTFL refresher course from May 19 through 21, 2015, in Erlanger, Kentucky, at the CMAD/ERT facility. The second is scheduled for the week of September 28, 2015, at the Tribal Air Monitoring Support Center in Las Vegas, Nevada. During the May 2015 RTFL training, 14 participants completed training related to instrument quality control (QC) and start-up; instrument use and readings interpretation; sampling of air, soil, and ground vegetation; and contamination control and avoidance. Participants also filled out sampling forms identical to those used during an actual event, completed a 1-day field exercise based on the evolution of an actual release, and acted out various Incident Command System (ICS) roles. On the last day of the May training session, presenters from FEMA and RadResponder delivered presentations about the expected impacts of various release scenarios and how the RadResponder app could be used to improve situational awareness.

Reviews of the May RTFL refresher course were very positive, and the training team will deliver the same agenda when the training is offered again in 2016. RTFL refresher training continues to enjoy good instructor support from Regions 1 and 5 as well as the Special Teams. For the Las Vegas course, current ideas for extending the impact of RTFL training include inviting OSCs to participate and meet with the RTFLs, inviting state and local health physics resource experts, and inviting University of Las Vegas Health Physicist program students. In the future, CMAD hopes to provide RTFL training at venues such as the Oak Ridge Y-12 Plant, the Nevada Test Site, and the Savannah River Site.

"I benefited most from the instrumentation checks module of the course. Instrumentation checks are necessary because we don't get to use them often enough and need to establish proficiency.... Also, the Decon Line in miniature was great because we were able to discuss set up variability over multiple designs and real world applicability..."

Excerpt from an RTFL course evaluation

RTFL students conduct contamination survey during exercise in Erlanger, KY.

RTFL participants use a black light to check decontamination procedures (fluorescent surrogate used to show cross contamination) during exercise.

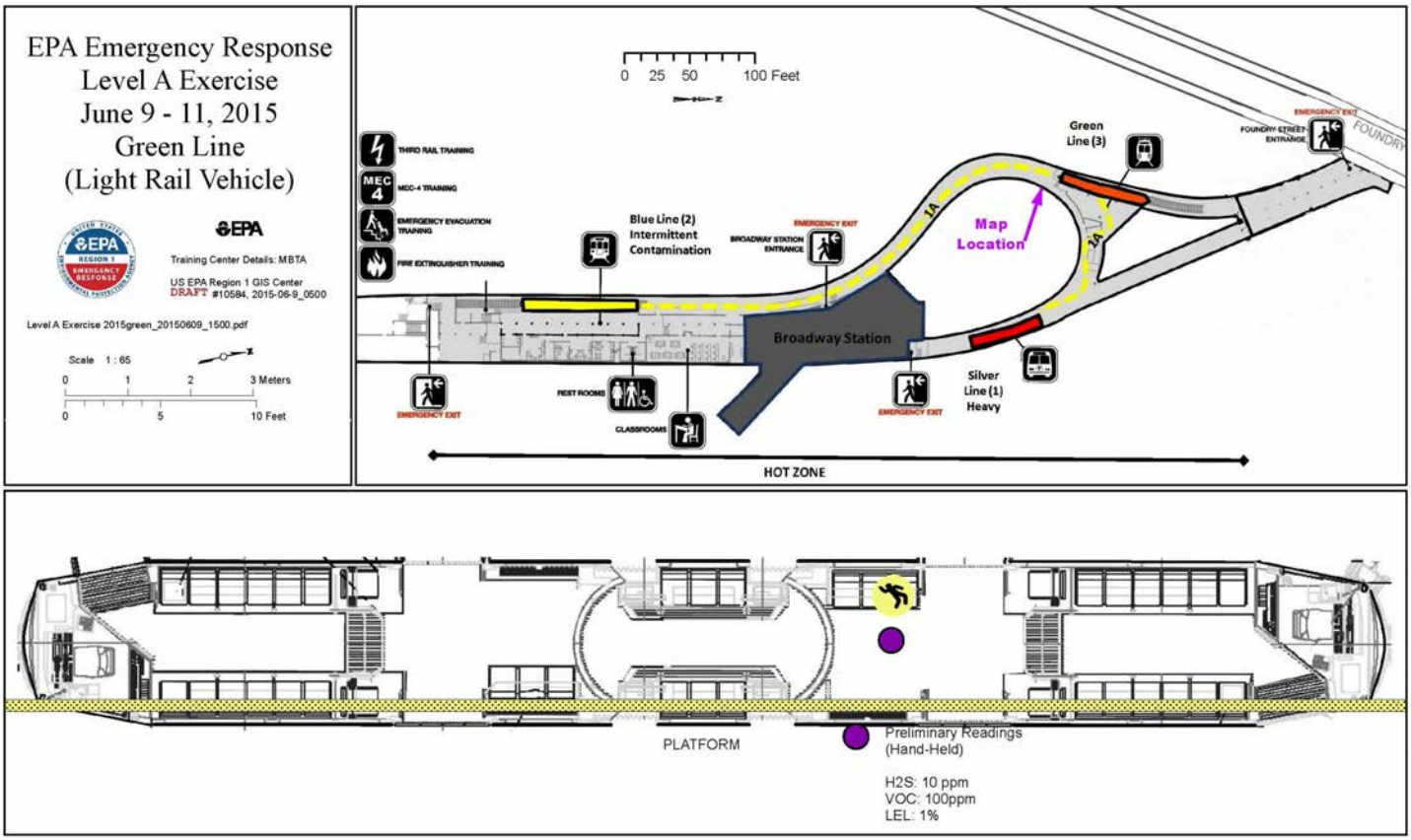
Region 1 Incident Management Team (IMT) and Level A Exercise at the Massachusetts Bay Transportation Authority (MBTA)

In June 2015, CMAD and ERT personnel supported the Region 1 IMT and Level A Exercise at the MBTA training facility in Boston, Massachusetts. The exercise scenario involved a hazardous materials response to a chemical release of hydrogen sulfide by a person riding in an MBTA subway car. During the exercise, response personnel performing Level A entries to determine the extent of contamination inside the railcar discovered a container of white powder amongst the suspect's possessions. Because the initial scenario involved a chemical release only, the IMT's Environmental Unit provided guidance for adjusting the decontamination line for the possible presence of a biological agent.

The following day, CMAD personnel provided a Biological Decontamination Line SOP for personnel decontamination and assisted the Region by establishing a Technical Working Group to assist the Environmental Unit in developing a Characterization Sampling and Analysis Plan and a Subway Car and Platform Decontamination Plan.

During the last day of the exercise, CMAD personnel served as observers and technical advisors while Region 1 implemented the biological agent decontamination plans for both response personnel and the subway car and platform at the MBTA training facility.

Region 1 performing biological decontamination at MBTA Training Facility.



PHILIS Support to Chemical Stockpile Emergency Preparedness Program (CSEPP)

Region 8 invited CMAD to participate in the Pueblo Chemical Army Depot (PCAD) CSEPP's Incident Recovery workshop and table-top exercise in Pueblo, Colorado, in November 2014. The exercise focused on monitoring, sampling, and analysis activities after a release of chemical warfare agents (CWA) from the PCAD facility. The PHILIS laboratory was driven from Castle Rock to Pueblo to demonstrate EPA assets. CMAD gave a tour of the PHILIS mobile laboratory that generated tremendous interest by the PCAD CSEPP local and state community as well as the DoD.

In May 2015, CMAD staff also provided support to the DoD's CSEPP at the Blue Grass Army Depot in Richmond, Kentucky. Region 4 invited CMAD to make a presentation about EPA assets and teams that could be mobilized for a CWA release. The Kentucky Department of Environmental Protection, local responders, and DoD counterparts on the Blue Grass Army Depot's CSEPP were unaware that the EPA has capabilities and assets such as PHILIS, ASPECT, the Trace Atmospheric Gas Analyzer (TAGA), or the Environmental Response Laboratory Network (ERLN).

Pallets of 155 mm artillery shells containing "HD" (distilled sulfur mustard agent) at a chemical weapons storage facility.

Photo Credit: U.S. Army Chemical Materials Activity

The ERLN is an integrated national network of public and private-sector laboratories that can be ramped up to support large-scale environmental response needs, such the analysis of CWAs in environmental samples after an accidental or intentional release. For more information on ERLN activities, please refer to Page 35.

PHILIS GC/MS Time of Flight (TOF) vehicle.

PHILIS Support of Region 1 Chemical Weapons Preparedness Laboratory and Field Exercise

In May 2015, CMAD deployed several PHILIS mobile laboratory assets from its New Jersey warehouse to the Region 1 New England Regional Laboratory in Chelmsford, Massachusetts. The purpose of the combined laboratory and field exercise was to support Region 1's chemical weapons preparedness capability. The laboratory portion of the exercise tested CWA-capable laboratory assets, both mobile and fixed, using the PHILIS mobile units, Region 1's fixed laboratory, and several New England area National Guard CST mobile screening laboratories. Wipe samples were spiked with CWA simulants and submitted to both the mobile and fixed laboratories for analysis.

The 1st CST collecting samples at the MBTA Training Center Blue Line subway car.

In addition, the CST and Region 1 OSCs and contractors conducted a screening and sampling functional exercise using CWA simulants at the MBTA training center. SOPs for the safe collection, transport, handling, triage, and analysis of samples potentially contaminated with a CWA were used during the exercise. This portion of the exercise was used to evaluate the inter-operability, SOPs, and Level A response efforts of EPA's regional assets and CMAD's and CST's mobile laboratory assets. An After-Action Report detailing improvements to the Region 1 CWA sampling, triage, and analysis SOPs is forthcoming.

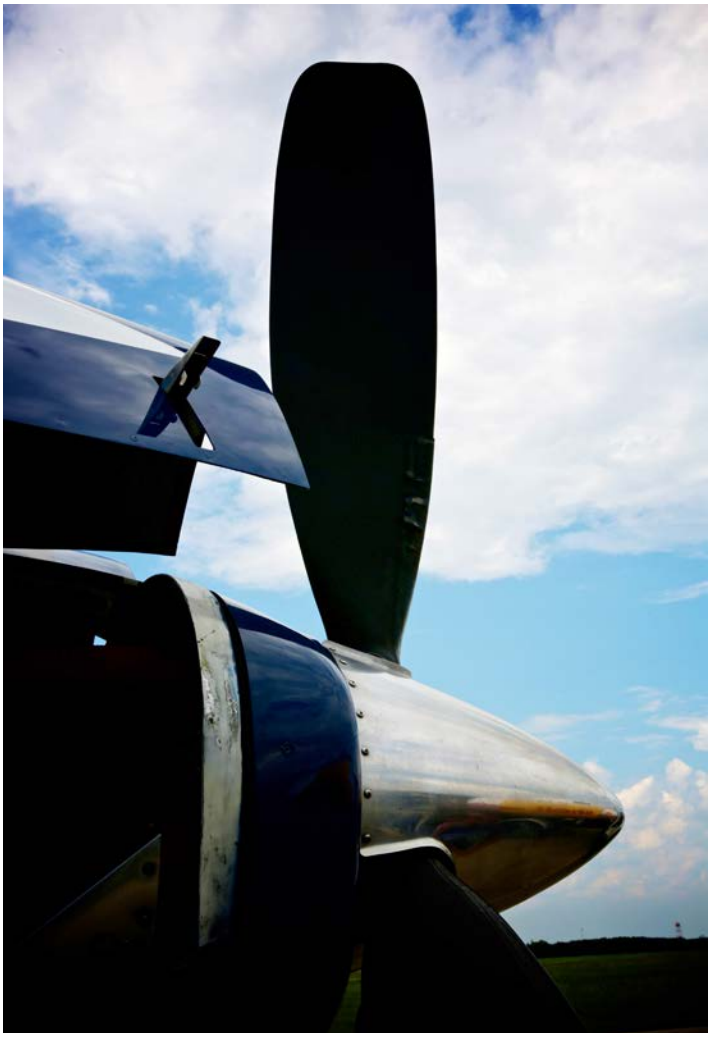
Operational briefing to explain Entry Team work assignments.

EPA and 1st CST prepare to make an entry into a MBTA articulating bus.

Exercise Photos Credit: Elsbeth Hearn

ASPECT Aircraft Deployment at Finding Lost Radioactive Sources Joint Training Exercise

The CBRN CMAD Field Operations Branch participated in a joint radiological field training exercise with the Washington State National Guard Region X Homeland Response Force (HRF). The exercise involved conducting operational responses to simulate finding lost industrial radiological sources. A member of the 10th Weapons of Mass Destruction CST joined the exercise as a science/liaison officer between HRF, CST, and ASPECT personnel. The three radioactive sources used in this exercise were CBRN CMAD Nuclear Regulatory Commission (NRC)-licensed materials.



Nose cone of ASPECT aircraft.

> ***"The ASPECT was very beneficial. It was an asset that we weren't really familiar with, initially, but bottom line – whenever you have somebody who can get in the air – they can look at the site of the critical incident, they can gauge what types of contaminants might be in the area – very valuable, because that gives us, as an Operations Cell, the ability to put together a plan, communicate not only with the joint elements, but also with First Responders."***
>
> **Sergeant Major Shawn Powell,**
> **HRF FEMA Region X Senior Enlisted Advisor**

The objectives of the joint training exercise were as follows:

1. Conduct full integration of the ASPECT scientific reach-back team with the HRF and 10th Weapons of Mass Destruction CST field structure
2. Test the use of the HRF Defense Connect Online (DCO) communication system to transmit a live feed of the ASPECT computer monitor to HRF and CST officials
3. Ensure the ASPECT products provide usable information to HRF command personnel to allow informed decisions
4. Determine the format of ASPECT products (such as Google Earth, Environmental Systems Research Institute [ESRI], etc.)
5. Learn about the HRF and ASPECT programs

The three radioactive sources were hidden in an unpopulated, 2-square-mile area near Spokane, Washington. On November 1, 2014, the ASPECT aircraft was deployed from Seattle to survey an area near Spokane and transmit data back to the Seattle-based Tactical Operations Center for product development and distribution. The ASPECT aircraft completed the aerial survey in about 20 minutes. All three sources were detected and identified, and ASPECT products were delivered to HRF and CST officials within minutes of initial detection. The ASPECT products were in Google Earth format as preferred by the HRF and CST.

The ASPECT products from the exercise are available at:

http://www.epaaspect3.net/googleearth/Washington_NG_rad_Nov2014/main/kml/Washington_NG_rad_Nov2014_main.kml

A 75-second video of HRF comments after the exercise is available at:

http://youtu.be/nY8Nvc4DwxY.

New ASPECT Technologies for Detecting Chemicals and Radiological Species at Lowest Possible Levels

The ASPECT aircraft is the only airborne remote sensing system in the United States that provides chemical, radiological, and situational awareness information in a timely manner to support first responders. To support responders, the ASPECT aircraft must be able to "detect" chemical vapors and radiological species at levels so low that the ASPECT aircraft has been described as needing to "find a needle in a hay stack." The challenge to the ASPECT aircraft is the detection of chemical vapors and radiological isotopes while the aircraft is flying several hundred feet over an incident site. The typical levels of detection required by the ASPECT system are the low-ppm range for chemical vapors, a few microCuries for gamma radiation, and a few counts for neutrons. The chemical or radiological (gamma) signal that indicates detection comprises less than 1% of the total signal intensity collected by the ASPECT sensors. In mathematical terms, ASPECT must be able to detect chemical and radiological signatures that are -40 decibels from a normal intercepted signal.

To achieve such low detection levels, the ASPECT aircraft must use the best detection technologies available, including the Versatile Spectro-Radiometer (VSR) and the Boron Trifluoride (BF3) Neutron Detector as discussed below. Each technology allows ASPECT to provide vital information to first responders as quickly as possible.

The chemical or radiological (gamma) signal that indicates detection comprises less than 1% of the total signal intensity collected by the ASPECT sensors. In mathematical terms, ASPECT must be able to detect chemical and radiological signatures that are -40 decibels from a normal intercepted signal.

Versatile Spectro-Radiometer (VSR)

Due to their structure and types of electron bonds, most organic compounds selectively absorb infrared (IR) energy, allowing a unique IR spectrum (signature) for that compound than is detected using a spectrometer. ASPECT uses this characteristic, coupled with a multi-dimensional pattern recognition algorithm, to "detect" a vapor. ASPECT also can estimate how much of the chemical is present, permitting a hazard assessment that provides critical information to first responders.

Versatile Spectro-Radiometer.

Neutron Detector.

Remotely quantifying chemical concentrations using an IR spectrometer is not easy. To facilitate an automated quantifying method, a radiometrically calibrated IR spectrometer called a VSR has been installed in the ASPECT aircraft. The VSR has two integrated calibration sources called "blackbodies" that generate extremely accurate radiometric signals at two temperatures. By periodically collecting data from these sources while the ASPECT aircraft is in flight, the team can develop algorithms to convert the intercepted chemical signal into an IR intensity (watts per square meter) that permits a concentration to be calculated in near real time.

Boron Trifluoride (BF3) Neutron Detector

Neutrons are very big, heavy particles that are difficult to detect because they are uncharged. They can be detected only by measuring something that the neutrons interact with, and the detector typically must be very close to the source emitting the neutrons or be very sensitive. Historically, a helium-3 (3He) gas-filled detector was used for high-sensitivity neutron detection. The detector indirectly detected neutrons through an absorption reaction that generated hydrogen ions. The ASPECT system used a four-tube 3He system for several years with very good results. However, 3He gas is very expensive and has a very limited worldwide supply.

Accordingly, the ASPECT program explored alternative technologies for airborne neutron detection and found the BF3 detector, also called a "straw tube" detector. This technology detects neutrons using a similar principle as the 3He system at a fraction of the cost. Two BF3 detectors have been installed in the ASPECT aircraft, providing a 40% improvement in the overall sensitivity of remote neutron detection by the aircraft.

BSL 2 Enhanced Facility Laboratory in Lakewood, Colorado

To better serve our Regional clients, CMAD has been working to establish laboratory support for testing environmental samples potentially contaminated with biological agents. A major factor in adequately supporting Regional needs is the certification of laboratories at a minimum level of BSL 2. In July 2015, the CMAD Bio-analytical Laboratory in Lakewood, Colorado, was certified as a BSL 2 Enhanced Facility, meaning that the laboratory can receive and test diagnostic-sized environmental samples containing potential bioterrorism agents, including, but not limited, to *Bacillus anthracis* and ricin toxin.

The CMAD BSL 2 laboratory is supplied with both molecular- and micro-biological equipment including two ABI 7500 Fast Real-time PCR machines, a Janus Automated workstation, an AirClean PCR workstation, an IKA Microbial Culture shaker, and a Qubit fluorometer as well as multiple incubators and centrifuges. The laboratory also houses certified equipment such as a Class II Biosafety Cabinet, a chemical fume hood, and an autoclave. The laboratory was designed to be self-contained, having a separate liquid waste bio-tank and its own air supply and exhaust. All these features allow safe and reliable testing for the presence of potential environmental and bioterrorism pathogens.

20

Number of wipe samples CMAD's new BSL 2 Enhanced Facility laboratory can process in 1 day, including spore extraction from the sampled media, incubation, DNA extraction and purification, and then PCR analysis

The new laboratory operations and capabilities have been incorporated into the contract supporting EPA's mobile PHILIS laboratory to allow a well-developed technical and facility management team to support laboratory staff and operations. The revised PHILIS contract also will be used to develop biological methodology for implementation into PHILIS operations in Castle Rock, Colorado. Finally, the revised PHILIS contract allows reach-back capability with other production and research facilities to support our bio-analytical operations for method development, technical support, and surge capacity.

Gene expression analysis can be performed using the laboratory's two real-time PCR thermal cyclers.

Certified Biosafety Cabinet and Chemical Fume Hood that houses a Janus Automated Workstation for high throughput sample processing.

Lab equipment includes a microbial culture shaker and water purifier.

Microbiological equipment includes a water-jacketed incubator, multifunctional centrifuge, and an in-laboratory autoclave.

New PHILIS Support for Biological Testing for Anthrax and Ricin and for All-Hazards Receipt Facility (AHRF)

PHILIS personnel currently are working with EPA's NHSRC to develop test methods to expand the screening capabilities of PHILIS to include biological agents. A task is being added to the PHILIS contract to support biological testing for anthrax and ricin. The testing methods are being developed under an EPA OEM contract at the National Enforcement Investigations Center (NEIC) facility in Denver, Colorado. The revised PHILIS contract will support the NEIC laboratory and potentially serve the mobile PHILIS platform during biological incidents. The article about CMAD's new BSL 2 Enhanced Facility on Page 25 provides more information regarding the revised PHILIS contract.

In addition, to prevent samples contaminated with high levels of CWA from entering EPA's fixed or mobile laboratories, space is being designed in a current PHILIS vehicle to incorporate an AHRF. The AHRF will allow the technicians to screen incoming samples potentially contaminated with high levels of CWA (or other radiochemicals or explosives) before the samples are sent to a Regional CWA laboratory.

100-200

Number of CWA or toxic industrial samples that can be analyzed by PHILIS per day

PHILIS unit under consideration to be retrofitted for an AHRF.

ASPECT Live Demonstrations

For several years, the ASPECT system has been providing real-time data to users. However, marketing of the ASPECT system was complicated by the fact that potential users and clients never got to see the ASPECT system in action collecting and processing data, only the final products. To provide potential customers with a better understanding of the mechanics and operations of the ASPECT aircraft, CMAD decided to stage a series of demonstrations using an ASPECT aircraft to collect environmental data "live." The purpose of the demonstrations was to show the audience how the ASPECT system works, what products it can generate, and how the data may be used to support an array of missions. Each demonstration is discussed below.

ASPECT Joint Training Exercise Reported in Evergreen Magazine

The first live demonstration was conducted in October 2014, as part of an exercise in the State of Washington with the National Guard HRF. This demonstration is discussed in the article entitled "ASPECT Joint Training Exercise Reported in *Evergreen* Magazine" under the "Collaboration" section of this report. Although the ASPECT aircraft provided excellent support, the ASPECT program was not the main "star." The mission flown by the ASPECT aircraft for this demonstration was a component of a much broader, State-led effort. The exercise provided crucial opportunities for the ASPECT team to develop innovative solutions to address issues such as poor cellular network coverage, weather delays, and security issues associated with moving information from one program to another. All these issues have real-world impacts on the ASPECT program related to providing timely and accurate data to the customer. The team was able to maneuver through each challenge, with a small group of National Guard personnel watching the demonstration unfold.

ASPECT Flight Crew.

"This is what our aircraft was designed for…. ASPECT is the most sensitive and calibrated radiation detection system in the country that employs advanced algorithms based on EPA, IAEA and DOE methods. It is the ideal tool to characterize large areas for potential radiological contamination at or near background concentrations."

John Cardarelli, ASPECT Certified Health Physicist and Radiological Lead

220

Square miles surveyed by ASPECT aircraft in FY15

ASPECT Demonstration at CBRNe USA 2015 Conference

The ASPECT program next decided to increase its exposure and perform a live demonstration at the CBRNe USA 2015 conference from April 29 through May 1, 2015. The initial request focused on having the ASPECT system available for an open house, with a presentation at the conference on how the system works, its products, and its uses. The ASPECT team instead suggested a live demonstration, and the event planners readily agreed. The biggest challenge facing the team in setting up a live demonstration was generating a scenario that satisfied the following requirements:

- Creation of an environmental setting for the collection and processing of real-time environmental data this data, with a high degree of realism and real-world connection
- Deployment of the ASPECT aircraft in real time and in line, with a time window for data collection in a fashion that was both realistic and factual to the delivery of data
- Use only of equipment normally contained in the ASPECT team's backpacks (no resources or capabilities not actually used by the team)

9

Maximum number of hours that ASPECT can arrive anywhere in the continental U.S.

The ASPECT team was determined to let the audience see a realistic demonstration of the aircraft's actual capabilities, including all its strengths and disadvantages.

The live demonstration scenario focused on a lost industrial radioactive source, which was considered a very realistic scenario based on several recent events involving large and dangerous radioactive sources. A formal mission plan was developed to support the demonstration that consisted of placing a cesium-137 test source (activity levels in the low milliCurie [low megaBecquerel] range) at an unknown location in Texas. This location was chosen because of its proximity to the ASPECT aircraft home base in Addison, Texas. The cesium-137 radiological source was owned and controlled by the CBRN CMAD ASPECT program and therefore was in the custody of an authorized user in accordance with NRC license requirements. Collection of the data in Texas for a conference in Virginia highlighted the fact that ASPECT can support missions anywhere in the country or world if needed.

ASPECT team explains to an audience the on-board detection capabilities of the aircraft.

ASPECT tail wing.

The flight mission was designed to have the aircraft fly a regularly spaced search pattern over a ½-square-mile area to find the source. No one other than the on-site authorized user knew the location of the source. The mission design allowed a true blind assessment of having the program find the lost source. Other than the planned search area and pattern, the flight crew knew only the time window for the survey. Issues such as weather posed risks, which again provided a degree of realism.

The conference ASPECT team consisted of three individuals: aircraft handler, data manager, and radiological scientist. The conference room was set up after a break using a computer to show data results on an overhead screen. The conference room had no effective Internet connection, so all data management and analysis was performed using wireless MiFi cards.

The team began the presentation with a 15-minute summary of the ASPECT program, answered questions, and then initiated the demonstration. A real-time flight track of the aircraft coupled with a window showing actual gamma sensor results were shown on the main screen. A conference line then was established with the ASPECT team around the country using the aircraft handler's cellular telephone, and a message was sent by satellite to the ASPECT aircraft to begin data collection. The aircraft immediately began collecting data, and on the third pass, the crew indicated by a satellite message that it had observed a strong reading on the airborne sensor displays. The conference ASPECT team immediately extracted confirmatory data using the satellite link, and the location and confirmation spectral information was shown to the conference audience. The entire process required about 6 minutes. Within 25 minutes, the audience was able to view an aerial photograph and infrared images of the scene.

The demonstration was structured to allow the audience to ask questions and discuss issues while the aircraft collected data, again reflecting conditions during an actual response and making the demonstration very effective in showing how ASPECT can be used. The live demonstration lasted about 1 hour. The audience consisted of about 100 people, and no one left while the aircraft was collecting data. A lively question-and-answer session followed, with numerous positive comments about how the ASPECT system and data would benefit emergency managers during a response. ASPECT was given good reviews by the audience.

Future Live ASPECT Demonstrations

The ASPECT team is planning to conduct additional live demonstrations and welcomes the opportunity to work with any local, state, or federal partner. The program can conduct both radiological and chemical scenarios and can feed various types of GIS systems

Radiation Decontamination Application (Rad Decon App) to Support First Responders

The DHS Science and Technology Directorate and EPA have entered into an Interagency Agreement to identify best practices and to develop a software application to support first responders in making informed decisions about decontamination technologies to implement during the early phase of a large-scale radiological incident. The Interagency Agreement has four main tasks. The first three, led by EPA's NHSRC, involve researching, testing, and documenting best practices involving technologies for containment, gross decontamination and mitigation, and early-phase waste staging of radiological contamination. These three tasks will provide input for the fourth task. Task 4, being led by CMAD, involves the development of a Rad Decon App for use on mobile platforms.

Partnerships with EPA to support the Rad Decon App were developed with (1) the United Kingdom's Public Health England (UK-PHE), which authored the United Kingdom's "Recovery Handbook for Radiation Incidents" and other guidance associated with radiation response; (2) the National Library of Medicine (NLM), which developed and maintains the WISER software to provide emergency response information; and (3) DoD's Combating Terrorism Technical Support Office, which developed and maintains the Chemical Companion decision support software to aid first responders.

Throughout the development phase, responders from federal, state, and local agencies as well as SMEs from EPA's Regional Offices, Special Teams, and Program Offices provided invaluable support. Their contributions and ideas will be integrated in the Rad Decon App to meet the needs of the response community.

More than 60 stakeholders participated during three city outreach sessions in June 2014. Stakeholders clearly indicated that an electronic application would assist with decision making during the early stages of a response to a radiation incident. Stakeholders also emphasized that the decision-making logic outlined in the United Kingdom's "Recovery Handbook for Radiation Incidents" would be useful as a software application and that the ease of use and functionality of WISER and Chemical Companion make these two tools good systems for staging and maintaining the Rad Decon App.

A report on the stakeholder engagement activities is available upon request by contacting CMAD.

CMAD facilitates Rad Decon APP stakeholder meeting in Charlotte, NC.

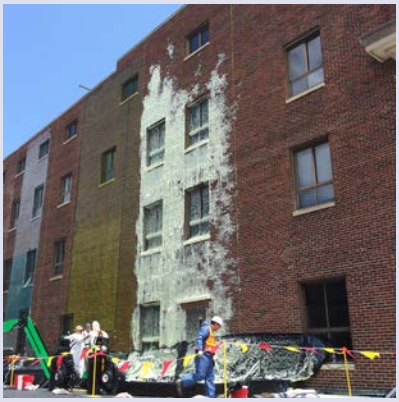
PHILIS Capabilities Showcased at 7th Annual CBRNe Convergence 2014 World Congress and Exhibition

In October 2014, CMAD deployed the PHILIS mobile assets to the 7th Annual CBRNe Convergence World Congress and Exhibition at Long Island, New York. The exhibition was well attended by renowned Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNe) experts from around the world from both the government and private-industry sectors. At the exhibition, CMAD staff showcased EPA's regional and inter-agency exercises for strengthening the nation's response to CWA attacks and demonstrated EPA's mobile capacity and capability for analyzing CWA-contaminated environmental samples using PHILIS. At the "Dynamic Demo" sessions of the conference, PHILIS detection levels were shown to be below risk-based clearance goal levels. CMAD's demonstration was featured in the "Latest News" section of the conference announcements.

PHILIS Portable Analytical Laboratory (PAL) with 6 GC/MS on board.

Radiological Decontamination Technology Demonstration

From June 22 through 25, 2015, NHSRC and Battelle held a large-scale radiological decontamination technology demonstration on the Battelle campus in Columbus, Ohio. CMAD radiological experts and managers observed the demonstration.



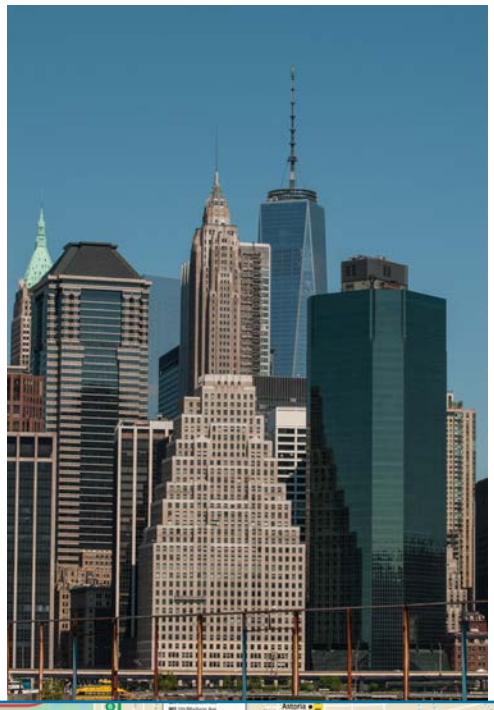
Demonstration of the foam decontamination system.

Most of the decontamination technologies centered on treating vertical surfaces to remove contamination from a theoretical radiological dispersal device release. Several private vendors and international government representatives demonstrated their technologies, highlighting the pros and cons of each technology for this particular application. Some technologies could be applied much more quickly than others (hundreds of square feet in less than 1 minute versus 20 or even 30 minutes per pass for the same area). These faster technologies would be much more suitable for a large-scale event than technologies relying on application by hand. The removal abilities were not tested during the demonstration, but bench-scale tests provided first-approximation results for decontamination factors and removal efficiencies for all technologies. Based on these results and strictly from an overall efficiency perspective, the speed of application and waste collection efficiencies of the technologies are primary considerations over the decontamination factors in choosing the most suitable technology.

One government service demonstrated its product and application process for a technology that uses an Air Dolly powered by a self-contained breathing apparatus tank. The delivery system could cover the vertical wall from the ground completely up past the third floor with decontamination foam in less than 1 minute. This system could conceivably treat more than one building per day, with a footprint that could fit in a common pickup truck or that could be supported by first responders with air compressors for their air tanks. In contrast, another vendor demonstrated a surface decontamination product that required hand application of a two-component system. Application required a lift or other means for accessing the vertical surface. Bench-scale testing showed comparable efficacy for each technology discussed above.

NYC Bio-Response Plan to Provide Tactical and Operational Guidance to NYC

A team led by the CBRN CMAD recently completed the NYC Bio-Response Plan. The team consisted of OSCs from Regions 2, 3, and 5 as well as members from several EPA offices, including the OEM, NHSRC, Office of Resource Conservation and Recovery, OCSPP, Office of Water, and Office of Homeland Security. The plan provides technical and operational guidance to the NYC DOHMH on preparing for a response to a wide-area release of a biological agent such as *Bacillus anthracis*. The objective of the bio-response plan is to provide tactical and operational guidance to restore NYC to operational status after a release of *Bacillus anthracis*. This objective is critical given the city's dense population, large subway system, key economic institutions, and unique urban environment. The plan focuses on *Bacillus anthracis* because it is persistent in the environment and difficult to inactivate. U.S. public health agencies currently have not established a minimum infectious dose for *Bacillus anthracis*, which is not the case for other biological agents.



Above: View of Lower Manhatten from Brooklyn.
Below: NYC MTA subway system.

New York City Photo credit: Diane Vatcher

The plan is structured to provide guidance on sampling, decontamination, waste management, safety, and other actions needed for successful remediation. Some of the more important aspects discussed in the plan are summarized below.

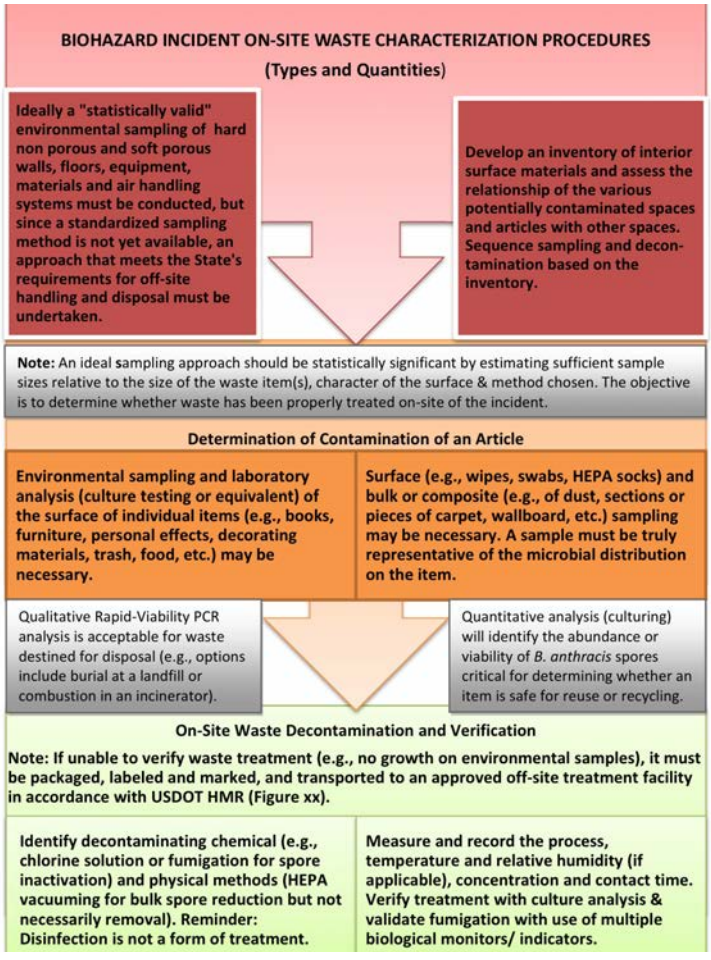
Many phases of a response are linked, and the path to reoccupancy should drive the overall strategy. Prioritization of resources and proper planning, preferably before an incident occurs, are critical so that essential activities for reoccupancy are not impacted. However, based on the unknowns associated with an actual incident, the plan does not provide step-by-step instructions for progressing toward reoccupancy. Also, the plan applies to NYC only and does not focus on an incident of any particular size. Rather, it provides guidance that is scalable and applicable to small-scale incidents (defined as affecting a single building) as well as to incidents that affect multiple city blocks, hundreds of facilities, and multiple response agencies.

One operational challenge related to a *Bacillus anthracis* event is evaluation of the extent of contamination through environmental characterization sampling. Sampling can serve both public health and remediation planning objectives. However, the plan focuses on sampling for remediation. Preliminary hazard assessments involve evaluating the environmental sampling data collected by first responders and health assessments conducted by public health officials. The number of characterization samples requiring analysis must be considered during planning. The information in the plan helps facilitate the development of characterization sampling plans to determine the extent of contamination and to identify areas that require decontamination.

Decontamination options depend on the characteristics of the *Bacillus anthracis* spores, the nature and the extent of contamination, and other site-specific parameters identified through characterization sampling. The limited response experiences for a large-scale *Bacillus anthracis* incident likely will result in a strong need to improvise and adapt commonly available resources and techniques to effectively decontaminate structures, furnishings, utilities, and other

materials. Some decontamination approaches presented in the plan have proven successful during real-world responses. During a response, responders may need to field-prove and modify the decontamination techniques discussed in the plan to help establish the process knowledge required for environmental- and site-specific conditions.

The plan also discusses one aspect often overlooked, the sampling of materials designated as waste. Waste samples also should be considered with regard to overall sample processing capacity. Pre-planning for waste management is critical to an effective and cost-efficient response. Therefore, it is necessary to develop a pre-incident Waste Management Plan that identifies methods for handling, transporting, storing, treating, and disposing of all potential waste streams from a wide-area event. The Waste Management Plan also should include waste acceptance criteria and facility willingness to accept the waste. Waste acceptance criteria for New York State stipulates that waste from a *Bacillus anthracis* incident is free of contamination ("zero growth").



Biohazard Incident On-Site Waste Characterization Procedures Flowchart from NYC Bio-Response Plan.

The NYC subway system is such a unique environment that a separate chapter of the plan focuses on the return to service of the subway system. Decontamination approaches, while similar to those for a building, are challenging to implement because of the environmental conditions in a subway system. Fumigants would be difficult to contain, and temperature and relative humidity target conditions would be difficult to achieve. The subway chapter also discusses a phased-approach that would use limited return to service of a particular line while the other lines are remediated.

Several final steps are needed to determine whether an area, building, or structure can be cleared for human occupancy. The plan contains guidance on developing a CONOPS for clearance. Clearance samples would require collection and analysis to determine if remediation efforts have achieved the clearance goal. Clearance goals inform all aspects of the remediation process, including characterization, decontamination, and clearance. EPA and NYC DOHMH support the use of the clearance goal of "no detection of viable spores on any environmental samples." Achievement of this goal should be confirmed with culture-based analysis. As for characterization sampling, the number of clearance samples requiring analysis must be considered during planning.

The plan also indicates that residents and businesses in areas outside of the exclusion zone would need information and guidance on how to minimize their potential exposure and reduce potential contamination in their homes, vehicles, and businesses. The plan includes information on how to clean pets that may have come into contact with *Bacillus anthracis*, information that helps the resident or business owner minimize the spread of contamination during the cleaning process, and information to prevent cross-contamination between clean and potentially contaminated areas. The guidance is not intended to be a comprehensive list of suggested actions but rather a set of recommendations to minimize potential risk.

Response and recovery after the release of *Bacillus anthracis* is certain to be a complex and resource-intensive undertaking, involving many challenges, resource limitations, and knowledge gaps. Throughout the plan, current gaps in knowledge and experience are identified for an incident involving *Bacillus anthracis*. Such gaps should be identified and planned for ahead of time to save lives, time, and resources. In addition, the plan identifies policy issues that warrant discussion amongst NYC agencies before an incident to allow the agencies to be better prepared.

In its entirety, the plan provides a single source of state-of-the art information and procedures for both pre-planning and disaster management to help NYC manage the magnitude and complexity of recovery operations required after a *Bacillus anthracis* incident. Completing this plan allows CMAD to develop wide-area biological tactical response plans that can be modified and apply to cities and communities nationwide.

Development of Chemical, Biological, and Radiological Tactical Guides

As part of CMAD's ongoing efforts to provide the most up-to-date and comprehensive information for chemical, biological, and radiological responses, tactical guides for each category have been developed. Specifically, CMAD led three workgroups to develop three tactical guides for remediation and recovery after a CWA incident, a biological incident, and a radiological incident.

The tactical guides will serve as a basis for sessions under the CBRN training track of the upcoming 2016 OSC Academy. The tactical guides are "living" documents and will be revised periodically to update operational protocols and incorporate new advances in decontamination science and research and development from NHSRC and other sources. Each guide is discussed below.

"Comprehensive Chemical Agent Tactical Guidebook for Consequence Management"

EPA's National CWA Preparedness Work Group consists of OEM and CMAD personnel, OSCs from all 10 EPA Regions, and staff from EPA's Special Teams (including the ERT and ORD's NHSRC). The work group's mission objectives are as follows:

- Ensure that operational needs and gaps related to CWA preparedness are identified, prioritized, and filled
- Ensure compliance with Core National Approach to Response CBRN requirements
- Serve as a vetting group for CWA exercises, training, and research and development projects to ensure that resources are focused on OSC priority needs
- Increase awareness and coordination between Regional OSCs, NHSRC, and Special Teams on CWA issues, including special incidents and sites, new technology developments, policy work, international work, interagency work, etc.

The EPA's National CWA Preparedness Work Group will serves as a focal point for addressing ongoing issues and concerns from the OSCs and EPA's response community.

"Comprehensive Biological Tactical Guidebook"

The "Comprehensive Biological Tactical Guidebook" was developed to provide the latest scientific, policy, and operational information to support field-level decision making during the consequence management phase of a response to a biological agent. The guidebook focuses on high-level, inter-related topics that should be considered during a response to a biological agent contamination incident with respect to characterization, decontamination, and clearance activities. The guidebook also provides technical information on biological agents and related risks, EPA response policy, notification and first response, worker health and safety, characterization sampling, data management, analytical methods, clearance strategy, decontamination, and waste management.

CBRN Training Track at OSC Academy

CMAD has championed and developed the CBRN training track for the Academy. The courses are designed for the senior OSC who would support the Incident Command or Unified Command during or in preparation for a CBRN event. The course was not designed as a "boots-in-the-mud course" typically offered to technicians. Instead, the 4-day course focuses on waste management; major CBRN response policies; reach-back assets available to the OSC; and specific chemical, biological, and radiological information that can also apply to "typical" hazardous waste sites.

Course planning involved numerous iterations for well over 1 year and included collaboration with CMAD members and OSCs and consultation with international and regional SMEs. In addition to the classroom training, CMAD will offer accompanying webinars and field exercises in the following months.

The CBRN training track will allow OSCs to become better prepared for CBRN responses and pre-deployments by offering a consistent stream of CBRN training that is up-to-date and applicable.

In addition, the guidebook also includes information from current research relevant to biological response and other resources available to operational decision makers. Technical, scientific, and policy gaps identified by stakeholders also are addressed, along with the current best practices to address these gaps. Two primary objectives of the comprehensive guidebook are to (1) provide OSCs with all relevant information that has been developed on response to biological agents in one document and (2) promote consistent application of scientific and technical information, guidance, policy, and technology across the EPA.

CMAD developed the guidebook in partnership with EPA OSCs who have experience in responding to biological incidents or who have served on the National Biological Response Work Group and with SMEs from the NHSRC, Office of Resource Conservation and Recovery, OCSPP, OEM, and DHS.

Bio-sampling exercise.

"Comprehensive Radiological Tactical Guidebook-Volume I, Emergency Response Phase"

This volume of the comprehensive radiological tactical guidebook focuses on critical decisions an EPA OSC must make during the emergency phase (typically, the first 72 hours) of a radiological incident. The incident scope may range from a radiological time-critical removal site evaluation to a radiological emergency response, although the guidebook primarily focuses on emergency response. The emergency response may involve a small, localized incident to a large incident requiring state and federal assistance and activation of the National Response Framework. The OSC and supporting EPA personnel may have complete responsibility for the incident or may support Incident Command or Unified Command in one or more roles.

The guidebook does NOT provide sufficient guidance on responding to an improvised nuclear device. However, many of the principles in the guidebook are applicable to such an incident. The guidebook also does NOT provide an all-hazards approach. Therefore, all non-radiological hazards should be considered because these hazards may be more (or much more) hazardous than radiological hazards. The guidebook not only provides guidance to the OSC for tasks and missions they may receive from Incident Command or Unified Command but also provides guidance that the OSC can provide as a resource to the Incident Command or Unified Command. Many of the Playbooks in the guidebook typically are not the responsibility of the EPA but are provided as a resource for the OSC to provide to the Incident Command or Unified Command.

2

Number of Certified Health Physicists on staff

Environmental Response Laboratory Network (ERLN) Activities

During FY15, CMAD made continuing efforts to provide EPA regional responders and Program Offices with quick and easy access to commercial, state, and federal laboratory capabilities and capacity through the ERLN. The ERLN offers environmental testing laboratories that are accredited, meet specific ERLN requirements for capacity, offer all-hazards/all-matrix testing capabilities, and are quickly accessible through pre-arranged basic ordering agreements. The ERLN also provides support to help the laboratory services requestor develop necessary analytical requirements and to liaison between the laboratory, the requestor, and the requestor's support teams and contractors (such as Superfund Technical Assessment and Response Team [START] contractors). Examples of activities performed by the ERLN are summarized below.

Decommissioning of EPA Radiological Laboratory in Las Vegas

ERLN support was exemplified in 2015 during the decommissioning of the EPA radiological laboratory in Las Vegas. ERLN worked with EPA's ORIA to procure and coordinate the analysis of approximately 3,400 wipe samples at a cost of about $73 per sample. The sampling at the laboratory was divided into separate phases. Each phase required coordination between ERLN support members and ORIA staff and involved (1) determining analytical requirements, (2) notifying the laboratory of the requirements, (3) obtaining quotes from the laboratory, (4) obtaining funding from ORIA, and (5) having an EPA contracting officer instruct the laboratory to begin work. Each phase took fewer than 48 hours to complete.

Integrated Consortium of Laboratory Networks (ICLN) Table-top Exercises

The ERLN remains very active in the DHS's ICLN. CMAD and partnering staff from the NHSRC, Office of Water, and ORIA have continually provided technical expertise and leadership in ICLN activities. Two comprehensive table-top exercises were conducted by the ICLN during FY15. The first table-top exercise involved a hypothetical terrorist attack at Washington, DC's Reagan National Airport. The scenario involved cyclosarin contamination of the luggage and ticketing area at one terminal, including a section of the terminal holding a jazz concert. Because of human traffic leaving the airport, parking and taxi transport areas and a major branch of the Washington Metro System also were contaminated. The objectives of the first table-top exercise included the following:

- Educating ICLN members and participating departments and agencies about the lead ICLN National Coordinating Group (NCG) network(s) and how to respond together during an incident
- Clarifying the CWA laboratory activation process (who calls whom)
- Ensuring practical utilization of the ICLN Portal, and performing activities noted in the ICLN NCG SOP
- Creating a database that lists laboratories that can analyze CWA samples
- Documenting and coordinating sampling plans for CWA at the airport for human clinical, crime scene, and environmental sampling (extent of contamination, efficacy of decontamination, and clearance)
- Estimating the number of samples (human clinical, environmental, and other) that would be generated by the incident

The second table-top exercise focused on a hypothetical release from the Bellingham Nuclear Power Plant in northern Washington State. The scenario involved a release after a 9.0 magnitude earthquake in the Bellingham area. This release scenario impacted human populations living in the area, agricultural lands used for growing crops and grazing animals, food storage and distribution facilities, and economic and transport centers shut down as a result of the incident. The following matrices were sampled and required analysis: human clinical, environmental, food, animals in the field, and plants and crops in the field. Participating networks and agencies included the DOE, EPA ERLN, CDC Bio-Rad laboratories, Food Emergency Response Network, National Plant Diagnostic Network, DoD Laboratory Networks, and Veterinary Laboratory Investigation and Response Network.

Most of the second exercise objectives were similar as those listed above for the first exercise, but the second exercise scenario included the following additional objectives:

- Introducing the planning team to the ICLN Data Sharing Agreement Template, and practicing filling out the template form
- Determining and applying appropriate existing federal plans, procedures, and guidance associated with responding to a nuclear power plant incident
- During extended operations, setting up and practicing an organized way to pass information from outgoing network and agency representatives to incoming representatives
- Evaluating the ability to upload and download large data files in a timely manner, and testing the new features of the ICLN Portal
- Selecting the Minimum Data Element variables necessary to include in the data report (included in the filling out of the Incident-Specific Data Sharing Agreement)

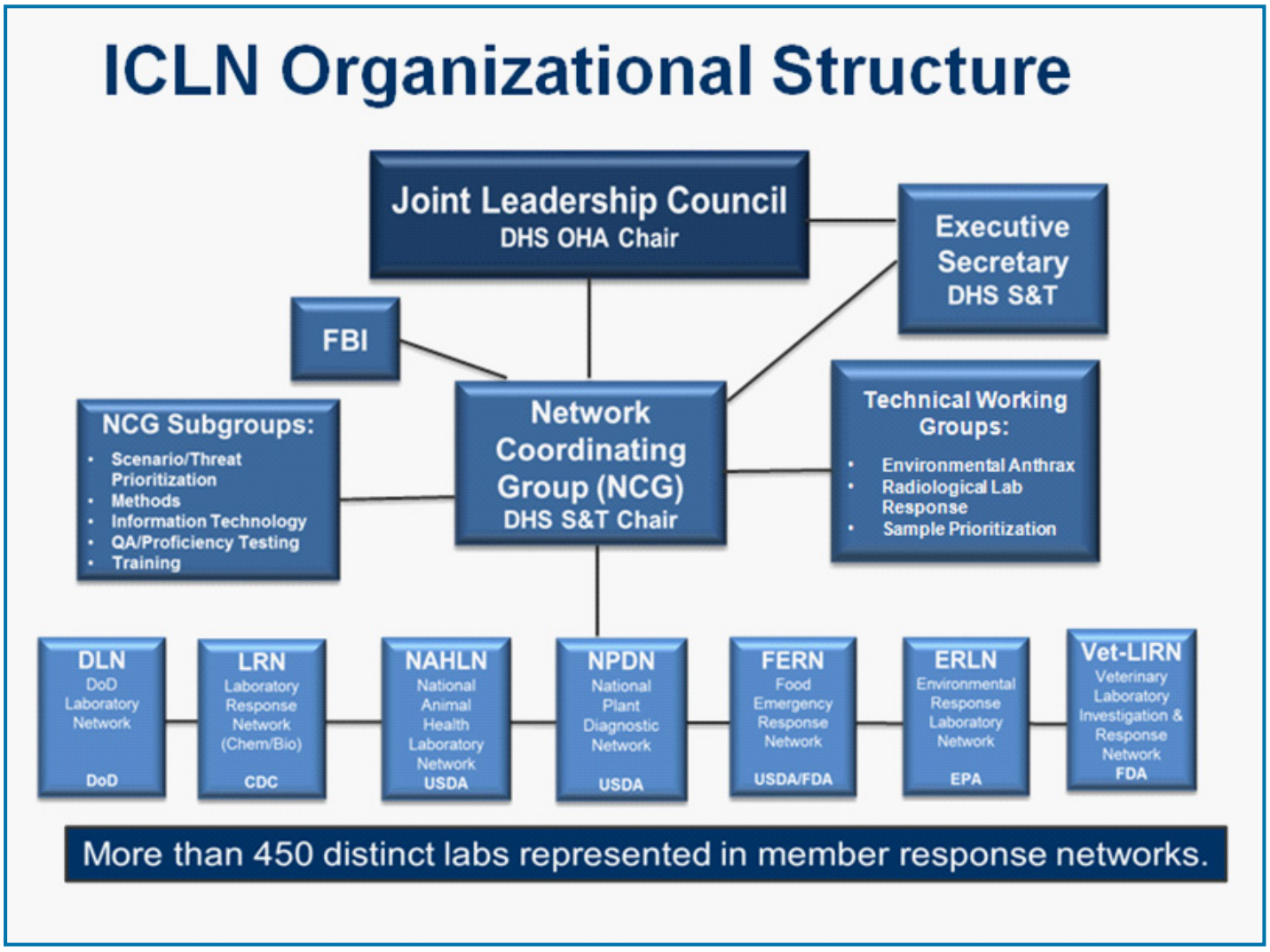
2015 Strategic Planning Meeting

The ICLN convened a Strategic Planning Meeting in 2015 during which leaders from each network and members of the ICLN NCG met to discuss future efforts. Notable discussions focused on the following:

- Process for transferring the chair of the ICLN from the DHS Science and Technology Directorate to the DHS Office of Health Affairs in 2016 to allow the ICLN to perform more as an "operations" function instead of a "research" function
- Approach for interacting with international laboratories and laboratory consortia
- Preparation of a strategy for developing a Radiological Response Laboratory Network
- Review of the exercise process and structure of the ICLN table-top and confidence-building exercises
- Training needs for ICLN networks and associated agencies

143

Number of ERLN Labs
Federal-State-Commercial
Chem-Bio-Rad



Selected Analytical Methods for Environmental Remediation and Recovery (SAM) Summit 2015

In continuing partnership with EPA's NHSRC, CMAD and OEM staff and management presented and participated in the 2015 SAM Summit from April 28 through 30 at the EPA office in Cincinnati, Ohio. Approximately 40 representatives also attended the summit from the Office of Water (Engineering and Analysis Division and Water Security Division), ORIA, Office of Resource Conservation and Recovery, ORD centers outside of the NHSRC, the EPA Region 10 Laboratory, Milwaukee Health Department School of Public Health, New Hampshire Department of Health and Human Services, Rhode Island Department of Health, Tennessee Department of Environment and Conservation, and Utah Public Health Laboratories. The purpose of the summit was to bring together NHSRC stakeholders to discuss important issues for inclusion in the next SAM document to be released in 2017. The most current version of the SAM document is the 2012 release available at: http://cfpub.epa.gov/si/si_public_record_report.cfm?subject=Homeland%20Security%20Research&dirEntryId=245280.

The primary objectives of the summit were as follows:

1. Identify stakeholder needs and research gaps
2. Identify strengths and weaknesses of sampling and analysis outputs
3. Write charge questions for technical work groups that will meet over the next 3 years
4. Identify relevant and useable sampling and analytical products and outputs

During the summit, individual presentations and panel and general discussion sessions were conducted for general participants as well as individual breakout sessions for the Chemistry Methods, Radiochemistry Methods, Pathogen Methods, and Biotoxins Methods Work Groups. Presentations made during the summit by CMAD representatives emphasized the issues summarized below.

- During an incident, responders need to know laboratory capacities and methods quickly.
- Optimized sampling procedures are needed for all phases of a response.
- Optimized analytical methods are needed, with detection limits applicable to the phase of the response (for example, a detection limit that allows a public health official to clear a contaminated area).
- There is a need to ensure the comparability of results between laboratories when multiple laboratories are used.
- Data management practices require optimization.
- To prevent samples contaminated with high levels of CWA from entering EPA's fixed or mobile laboratories, NHSRC needs to design a current PHILIS vehicle to incorporate an AHRF to screen incoming samples potentially contaminated with high levels of CWA.
- There is a need to utilize procedures owned by other agencies (such as the CDC) and to formalize a process by which EPA can more easily partner with other agencies to gain support for analyses for which EPA has little or no capability.
- SAM method summaries could help with coordination between the laboratories and field. The summaries include the original method reference, technique, original use, and the intended use.
- Incident information should be communicated to all involved parties. Laboratories should receive the following information: number of samples, sample volume, field QC requirements, prioritization of sample analyses, contaminant levels, moisture content, unusual matrices, physical descriptions, dilution levels, and all other field data relevant to analysis.
- There is a need to determine how field data will be managed and provided to laboratories. Potential solutions may include Cloud-based systems, photographs, and other methods. Also requiring consideration is how to filter out important information and convey it to the people that need it.
- There is a need to determine if SAM could include recommendations for screening equipment, including calibration and proficiency testing. These recommendations currently are beyond the scope of SAM. Information on calibration and proficiency testing should be included in a Quality Assurance Project Plan (QAPP).

Other topics discussed during the general and breakout session meetings at the summit included the following:

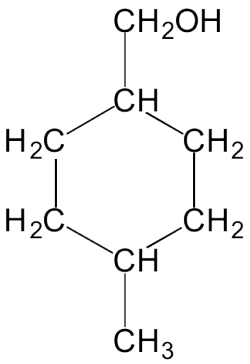
- Communication process between laboratory and field personnel within the framework of the ICS, including communication on quality assurance (QA)/QC issues
- Data management for small- and large-scale incidents
- Process for analyses of unique samples and accessing technical expertise

- Documentation of uncertainties in SAM for specific matrices
- Need for an example QAPP in generic language
- Procedures for reducing sample particle size for matrices such as building debris
- Instructions for unusual sample types that the laboratories do not have experience in analyzing
- Evaluation of sample holding times for the methods, especially during the recovery phase of an incident
- Better understanding of analytical methods for chemical contaminants in air, which are needed for long-term monitoring
- Divisions within ORD (such as the National Risk Management Research Laboratory, National Exposure Research Laboratory, and NHSRC) that could coordinate method development and validation, particularly for fractionation (frack) waste and oil and combustion byproducts of oil spills; specific methods discussed included quantitative PCR for beach monitoring, Methods 544 and 545 for cyanotoxins, Method 1611, Method 1609, and an E. coli method being developed
- Consideration of NHSRC serving as the coordinator for method harmonization between multiple groups
- Request of comments from personnel involved in an Environmental Unit during a response on the most user-friendly format
- Characterization of matrix interferences from decontamination chemicals, particularly for biological analyses (for example, use of bleach or methyl bromide as disinfectants)
- Reach-out to other organizations and agencies (such as the Association of Public Health Laboratories, CDC, the Food and Drug Administration, and USDA) for analytical methods, particularly biological methods

PHILIS Support during Elk River Response in West Virginia

On January 9, 2014, an estimated 10,000 gallons of the industrial chemical 4-methylcyclohexanemethanol (MCHM) spilled into the Elk River just upstream from the Kanawha County municipal water intake in Charleston, West Virginia. MCHM is used for coal preparation and processing. Water used by nearly 300,000 people was affected by the chemical spill. Because of uncertainty about chemical levels in the water supply, a "Do Not Use" order was issued. Later that evening, the West Virginia Department of Environmental Protection contacted EPA about the release and requested assistance.

As part of the EPA response efforts, PHILIS was used to support an analytical method validation exercise for a draft air method developed by the EPA's ERT in Edison, New Jersey, for analyzing MCHM in air samples.



Chemical structure of MCHM.

EPA responders on the Elk River, WV.

Collaboration Efforts with the NHSRC

CMAD and NHSRC work hand-in-hand to research, develop, and deliver useable scientific methods to the response community to address CBRN threats. NHSRC's research and work is done primarily in a laboratory setting using bench scale models and techniques, and CMAD and EPA OSCs collaborate with them during this phase to provide useful and relevant field experience and to help identify beneficial outputs. CMAD is then responsible for taking the findings identified by NHSRC and conducting full-scale field studies. During this phase, OSCs and NHSRC are members of the field study to provide both a field and laboratory perspective. When the laboratory and field tests are done, products and methods are transferred to the OSCs and the response community as final products. Some examples of these many collaborative efforts are summarized below:

Study of Potential for *Bacillus anthracis* Spore Transport from Urban Surfaces During and After Precipitation

In an urban environment, the release of a biological agent such as *Bacillus anthracis* spores could contaminate large areas. This study narrowly focuses on the potential for *Bacillus anthracis* spore transport from urban surfaces during and after precipitation events. The main process affecting spores is adsorption onto a solid. In storm water, these aggregates then are transported with sediment particles in water. Many deposited spores could be removed from urban surfaces during the early phase of a precipitation event using the "First Flush phenomena." However, this phenomenon needs further study. Many research questions must be answered to inform site characterization and sampling strategies after an urban release.

CMAD Director addressing 2015 Decontamination Conference.

Report on Cesium-137 Wash Aid System

The NHSRC, in conjunction with CMAD, prepared a report that discusses the cesium-137 wash aid system. This system provides options for responders performing gross radiological decontamination after a wide-area release of cesium-137 (for example, from a radiological dispersal device, improvised nuclear device, or nuclear power plant). The system minimizes the consumption of water and the amount of waste, especially contaminated water. This report is the first of a series of reports that will be prepared for addressing contamination with strontium-90 and americium-241.

Assessment Report of Spray Techniques during Decontamination of Materials Contaminated with Chemicals

The NHSRC, in conjunction with CMAD and OSCs, prepared this report, which describes results from a bench-scale study that compared two spray techniques to apply decontaminant solution onto surfaces with different spatial contamination patterns.

Evaluation of Foam-Based Decontaminants

The NHSRC, in conjunction with CMAD and other partners, will conduct this evaluation to compare fundamental aspects (such as the efficacy, wetting time, etc.) of spray-based sporicidal decontaminants applied as a liquid versus a foam. Findings will be used to determine the best conditions for applying a foam versus a liquid decontaminant.

Evaluation of Decontamination of Subway and Other Materials through Fogging of Sporicidal Liquids

The NHSRC, in conjunction with CMAD, OSCs and other partners, will conduct this evaluation to investigate the efficacy of a commercially available fogging system or systems to deliver sporicidal liquids (such as peracetic acid, pH-amended bleach, etc.). The evaluation will be conducted in a large test chamber to decontaminate subway-relevant materials as well as building materials contaminated with *Bacillus anthracis* spores or surrogates.

2015 EPA International Decontamination Research and Development Conference and Biological Preparedness Work Group Meeting

This year, CMAD personnel attended, facilitated, and presented materials throughout the NHSRC-sponsored 2015 EPA International Decontamination Research and Development Conference. Concurrent with the conference, CMAD also sponsored the Biological Preparedness Work Group meeting with OSCs from across the country.

The symbiotic relationship between NSHRC and CMAD will continue to fuel progress of technical advancements in the CBRN response arena. Our two organizations will continue to collaborate as NHSRC conducts their research in the lab setting/bench scale and CMAD uses the lab results to conduct field studies. Working together through both phases of lab and field study ultimately enables the transition of final products ready for use by OSCs and other responders. In FY16, we look forward to continuing these efforts with specific focus on: assessment of composite sampling and aggressive air sampling methods for anthrax; improved radiological decontamination methods and persistence of RDD contaminants on wastewater infrastructure surfaces and decontamination options; composite sample strategy options; and understanding regional natural disaster sampling and data needs during a wide area response.

A complete list of collaborative projects between NHSRC and CBRN CMAD is available on our website at http://www2.epa.gov/emergency-response/consequence-management-advisory-division-cmad

39

Number of current, ongoing research projects led by NHSRC, with CMAD collaborating on the project team

ASPECT Joint Training Exercise Reported in Evergreen Magazine

A live ASPECT demonstration was conducted in October 2014 as part of an exercise in the State of Washington with the National Guard HRF. This demonstration was reported in an article entitled “Eyes in the Skies” in Evergreen Magazine. A copy of the article is available at:

https://static.dvidshub.net/media/pubs/pdf_24260.pdf

EYES IN THE SKIES

Story and photos by: Pvt. 1st Class Brianna Patterson, JFHQ Public Affairs Office WANG

Camp Murray, Wash. — The Washington National Guard's Homeland Response Force (HRF) FEMA Region X is continuously training and preparing to respond in the event of a local, state or regional emergency. The Homeland Response Force responds to chemical, biological, radiological, nuclear and high yield explosive threats, as well as large scale natural and man-made disasters.

The HRF remains ready to respond in the event of a disaster by continuously training within the HRF and with other agencies. The HRF conducted a joint training exercise with the Environmental Protection Agency's (EPA) Airborne Spectral Photometric Environmental Collection Technology (ASPECT) on November 1, 2014 in Seattle.

"The ASPECT is the nation's only 24/7/365 [sic] airborne asset that can do chemical, radiological and situational awareness in one single aircraft," said Captain John Cardarelli, U.S. Public Health Service Officer, liaison to the U.S. EPA.

"The whole doctrine behind the ASPECT program is to collect airborne remote sensed chemical, radiological and situational awareness information and data," said Mark Thomas, the ASPECT Program Manager. "Then to put that data into a format that can be rapidly provided to the first responders."

The ASPECT program can detect more than 75 compounds within a matter of seconds and, with a little more time, can detect 500 additional compounds. The ASPECT is designed to assist first responders, such as the HRF, by detecting, locating and identifying hazardous contaminants and relaying that information back to responders on the ground within five minutes of initial detection.

"We simulated lost industrial radioactive sources in the Spokane area," said Thomas. "We flew a flight pattern over that area, located the sources and then were able to give the position information and isotope identification of the sources to the HRF."

This [the ASPECT] gives us a lot of information prior to getting there for picking where we want our staging area and how we want to approach this so that we're minimizing our exposure," said Cpt. Wesley Watson, a Nuclear Medical Science Officer with the 10th Civil Support Team. "Not only that but it gives us an image overlay."

The ASPECT can give first responders several images including a base map, an aerial image, an infrared plume image, a radiological map and a chemical identification/concentration graph. These images can be very useful for first responders to plan their approach to a situation in the safest and most effective way possible.

"I was able to plug into the Defense Connect Online [DCO] where [HRF] assets opened up a guest account. I could share my screen with anybody who had access to that DCO account," exclaimed Cardarelli. "Anyone anywhere that has access to DCO would be able to actually observe what is being collected on the aircraft near real-time while the exercise is going on."

The ability to relay information between agencies is critical to the success of first responders. In order to be most successful in relaying information between agencies, there must be a common, easily understood language between agencies.

"As a civilian agency it's critical and important that in times of need that I know how to deal with the uniformed services, like the National Guard, and I think, likewise, they know how to deal with me," said Thomas.

"The biggest challenge that we have is being able to speak a common language to each other," said Sgt. Maj. Shawn Powell, HRF Region X Senior Enlisted Advisor. "Whenever you're working with first responders on an incident site there has to be a commonality in language and communication."

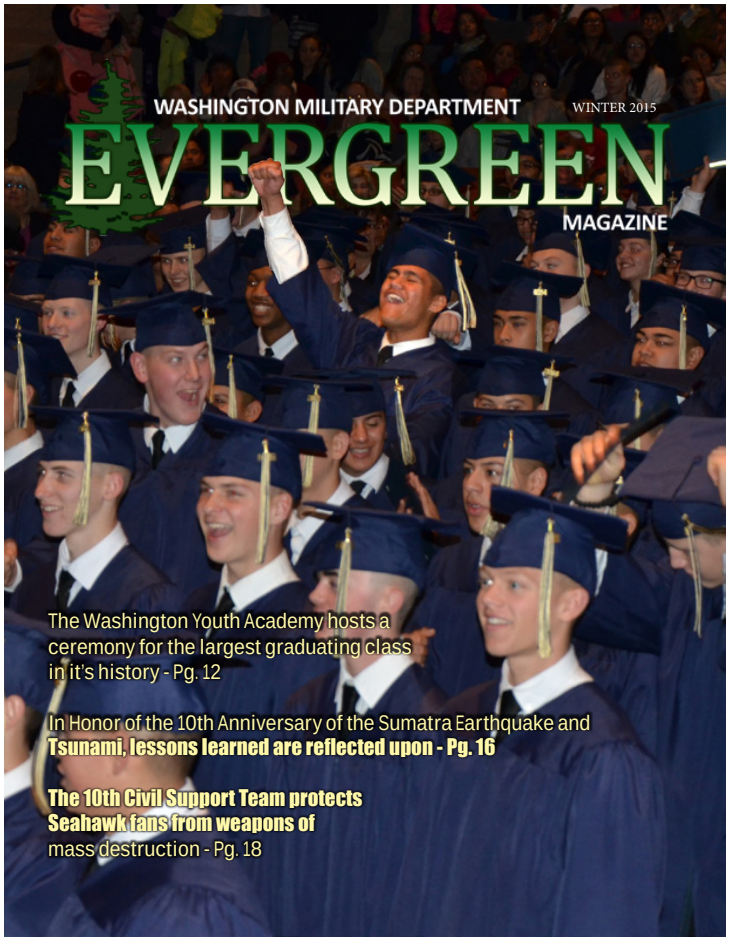
The HRF and the ASPECT team were able to establish a common language during the exercise making communication between both agencies very simple, which ended the day with a very successful training exercise.

"I was very impressed with the way the HRF operated," said Thomas. "They were able to pull our data in and put it into their status reports to satisfy their needs."

"I think they were incorporated very well and based on what they brought to the table for this exercise we'd like to incorporate them into future exercises," said Powell.

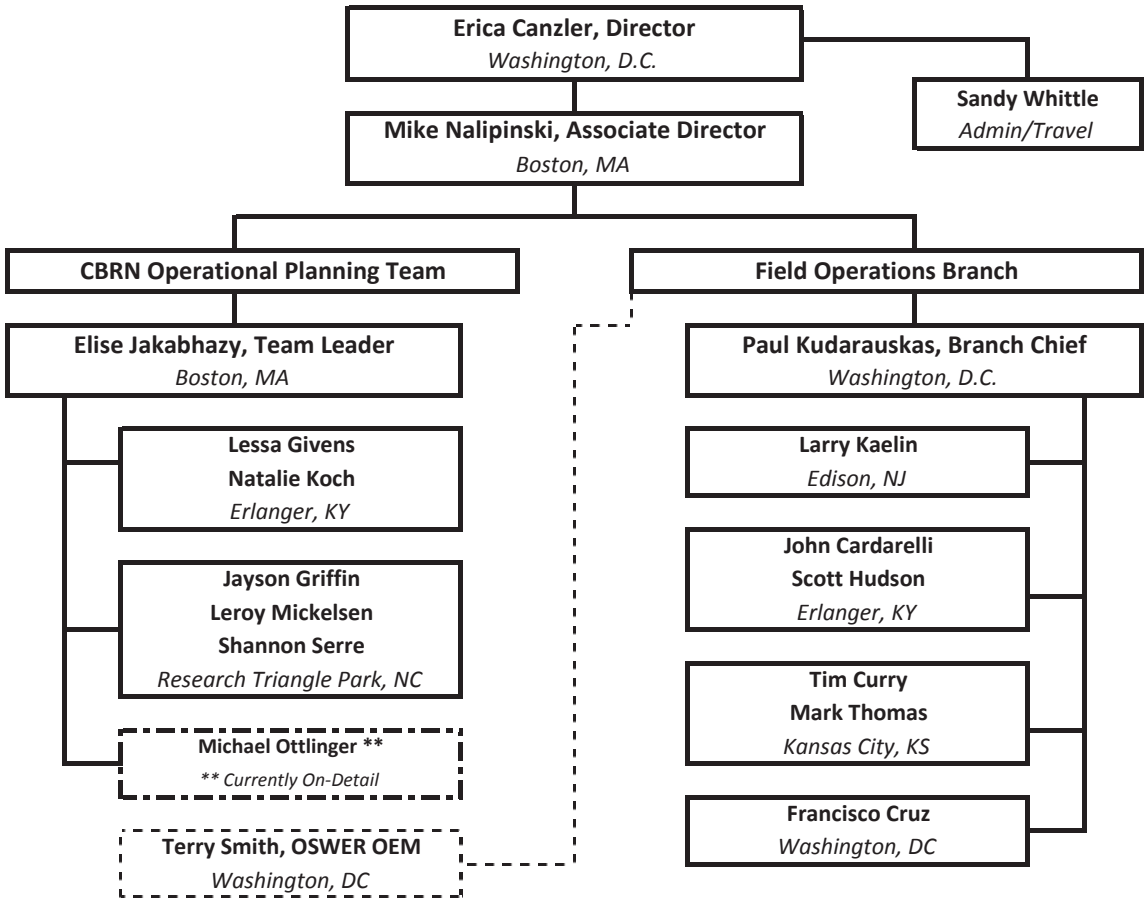
The EPA and members of the ASPECT team look forward to the opportunity to work with the Washington National Guard's HRF again, said Cardarelli, while the HRF looks forward to the possibility of incorporating them into future training exercises and of the HRF ever needs the ASPECT's assistance in a real world response an activation to simply a phone call away from the EPA's Emergency Operations Center.

The Environmental Protection Agency's Airborne Spectral Photometric Environmental Collection Technology (ASPECT) visits Seattle, on Nov. 1, 2014 to conduct joint training with the Washington National Guard's Homeland Response Force (HRF) FEMA Region X. The ASPECT team gives members of the HRF a tour of the ASPECT and shows them the various technology used on the airplane. (Washington National Guard photo by: Pvt. 1st Class Brianna Patterson, 122D Public Affairs Operations Center, WAARNG)



3He	Helium-3
AHRF	All Hazards Research Facility
APHIS	Animal and Plant Health Inspection Service
ASPECT	Airborne Spectral Photometric Environmental Collection Technology
BF3	Boron trifluoride
BSL	Biosafety Level
CBRN	Chemical, Biological, Radiological, and Nuclear
CBRNe	Chemical, Biological, Radiological, Nuclear, and Explosives
CDC	Centers for Disease Control and Prevention
CMAD	Consequence Management Advisory Division
CONOPS	Concept of Operations
CSEPP	Chemical Stockpile Emergency Preparedness Program
CST	National Guard Civil Support Team
CWA	Chemical warfare agent
DCO	Defense Connect Online
DHS	Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOHMH	Department of Health and Mental Hygiene
DPG	Dugway Proving Grounds
ECL	Electrochemical Luminescence
EPA	U.S. Environmental Protection Agency
ERLN	Environmental Response Laboratory Network
ERT	Environmental Response Team
ESRI	Environmental Systems Research Institute
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FY15	Fiscal year 2015
HRF	Homeland Response Force
ICLN	Integrated Consortium of Laboratory Networks
ICS	Incident Command System
IMT	Incident Management Team
IR	Infrared
LCHP	Low-concentration hydrogen peroxide
LRN	Laboratory Response Network
MALDIMS	Matrix-Assisted Laser Desorption Ionization Mass Spectrometry
MBTA	Massachusetts Bay Transportation Authority
MCHM	4-Methylcyclohexanemethanol

NCERT	National Counterterrorism Evidence Response Team
NCG	National Coordinating Group
NEIC	National Enforcement Investigations Center
NHSRC	National Homeland Security Research Center
NIOSH	National Institute for Occupational Safety and Health
NIRT	Nuclear Incident Response Team
NLM	National Library of Medicine
NORM	Naturally occurring radioactive material
NRC	Nuclear Regulatory Commission
NYC	New York City
OCSPP	Office of Chemical Safety and Pollution Prevention
OEM	Office of Emergency Management
ORD	Office of Research and Development
ORIA	Office of Radiation and Indoor Air
OSC	On-Scene Coordinator
PCAD	Pueblo Chemical Army Depot
PCR	Polymerase chain reaction
PHILIS	Portable High Throughput Integrated Laboratory Identification System
PPE	Personal protective equipment
ppm	Part per million
QAPP	Quality Assurance Project Plan
QC	Quality control
Rad Decon App	Radiation Decontamination Application
RCMA	Ricin Component Multiplex Assay
RERT	Radiological Emergency Response Team
RMSAA	Ricin Mass Spectrometry Activity Assay
RTFL	Radiation Task Force Leader
SAM	Selected Analytical Methods for Environmental Remediation and Recovery
SME	Subject matter expert
SOP	Standard operating procedure
START	Superfund Technical Assessment and Response Team
TAGA	Trace Atmospheric Gas Analyzer
TNPRC	Tulane National Primate Research Center
TRFIA	Time-Resolved Fluorescence Immunoassay
UK-PHE	United Kingdom's Public Health England
USDA	U.S. Department of Agriculture
VOC	Volatile organic compound
VSR	Versatile Spectro-Radiometer



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Chemical, Biological, Radiological and Nuclear Consequence Management Advisory Division

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