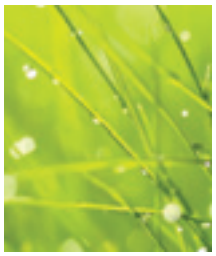

Chemical, Biological, Radiological, and Nuclear
Consequence Management Advisory Division

2017 ANNUAL REPORT

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Remembering Terry Smith

On June 1, 2017 we lost a dear friend, valued colleague, and dedicated public servant, Terry Smith. Terry had over 40 years of experience in analytical chemistry analyses, Quality Management, operations management and research. He joined the U.S. Environmental Protection Agency (EPA) in 1999 as a Program Manager with the Contract Laboratory Program (CLP), moved to EPA's Office of Emergency Management in 2005 to establish the EPA Emergency Response Laboratory Network (ERLN), including the Portable High-Throughput Integrated Laboratory Identification System (PHILIS) mobile operations and the EPA Chemical Warfare Agent Laboratory Program. He supported numerous emergency responses reaching every EPA region, including EPA support to the 9/11 attacks, Libby Asbestos, Deepwater Horizon, and Flint Michigan, to name a few. Terry was a modest, generous and devoted man with the knack to fit into any situation and always leveraged a positive outcome.

This is truly a great loss to his family, friends, Agency and to our community as a whole. He was always a pleasure to be with and will be deeply missed.

It is my privilege to highlight the achievements and efforts of the Office of Emergency Management's Chemical, Biological, Radiological, and Nuclear (CBRN) Consequence Management Advisory Division (CMAD) for 2017. The past year was a time of transition for the Division, yet the dedicated group of professionals who make up this organization never wavered in providing the high-quality technical support and response assistance that is the cornerstone of EPA's CBRN preparedness activities.

The year opened under the leadership of Dr. David Charters, who ably served as CMAD's Acting Director through May of 2017. We sincerely appreciated having him on loan from the Office of Superfund Remediation and Technology Innovation, and CMAD benefitted greatly from his contributions. I am honored to have taken over this role in May of 2017, and am proud to call CMAD my new home.

As with previous years, this annual report discusses regional support, projects, field studies, training efforts, and responses that exemplify our partnerships with the U.S. Environmental Protection Agency (EPA) Regions; the EPA Office of Research and Development's National Homeland Security Research Center (NHSRC); other EPA Special Teams; and key federal agencies such as the Department of Homeland Security (DHS), the Centers for Disease Control and Prevention (CDC), and the U.S. Department of Defense (DoD). It provides details on some of CMAD's major efforts, including our continued work to investigate the fate and transport of biological agents and our efforts to develop guidance and tactics to support response and remediation decisions. It also highlights the support and services we provided through the Portable High Throughput Integrated Laboratory Identification System (PHILIS) program, various Airborne Spectral Photometric Environmental Collection Technology (ASPECT) deployments, and celebrates the success and growth of CMAD's Radiation Source Program. This year, however, I would like to use this letter as an opportunity to highlight something even more extraordinary: the collective efforts and sacrifices of the individuals who make up this Division.

In 2017, EPA was called upon to respond to an unprecedented hurricane season, concurrent with record breaking wild fires. These events left devastation in their wake, compromising the distribution of electrical power, rendering drinking water and wastewater treatment plants inoperable, and leaving buildings and entire landscapes damaged or destroyed. Details regarding the support that CMAD's mobile assets and response-capable personnel provided in response to Hurricane Harvey can be found in this report. Both ASPECT and PHILIS were deployed to the Houston area in support of Region 6 and they were instrumental in providing time-critical information to federal, state, and local partners involved in the response.

Here is what you will not find in this report: between Hurricanes Harvey, Irma, Maria and the California Wildfires, every CMAD staff member stepped up to support the Agency's mission by deploying as part of the Regional response to these events. In and of itself, that is not surprising - part of CMAD's mission is to directly support the field-based response. CMAD staff routinely serve as force multipliers, deploying as field personnel and providing unique technical expertise within the Incident Command System (ICS). From August through January, CMAD team members deployed for weeks at a time to staff the Headquarters and Regional Emergency Operations Centers, and fill various ICS positions - from command and general staff, to the on-the-ground group supervisors and assistant safety officers. However, without exception, each and every member of the Division *volunteered* to be deployed. They volunteered to leave behind their families – some more than once – over the holiday season. They volunteered to support the Agency and our Regional colleagues, as well as those communities affected by these disasters. They, along with the rest of EPA's emergency response personnel, embody the best of what this Agency is. I am honored to work with such a dedicated group of individuals.

We look forward to working with all of our partners during 2018.

Very Respectfully,
Gina Perovich
CBRN CMAD Director

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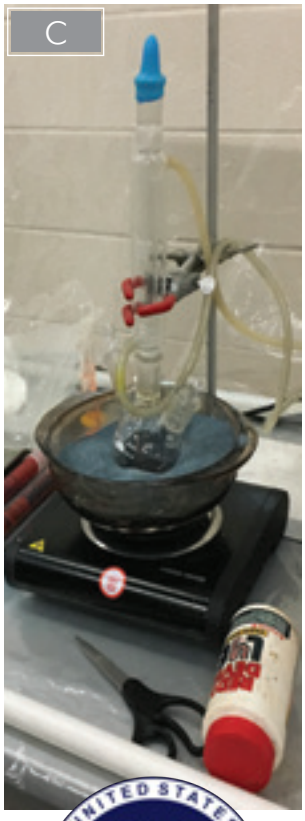

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TRAINING AND SUPPORT

A CST Training on a booby-trapped vehicle.

B CST training on handheld monitors.

C Mock clandestine drug lab setup for CST training.

D RTFL benthic sediment sampling.

E RTFL soil sampling.

F RTFL sampling exercise.

Chemical, Biological, Radiological, and Nuclear (CBRN) Consequence Management Advisory Division (CMAD) provides technical training and support to prepare response personnel through a variety of programs, such as the On-Scene Coordinator (OSC) Academy and Radiation Task Force Leaders (RTFL) trainings, and through presentations at U.S. Environmental Protection Agency (EPA) events such as Regional Response Team (RRT) meetings and national and international conferences. CMAD also provides subject matter expertise both on-site and as reach-back support for tabletop and field exercises. Several examples of CMAD training and support activities are provided below.

64th Civil Support Team (CST) Field Exercises

CMAD was invited, at the request of EPA Region 6 and the National Guard's 64th CST, to participate in two joint exercises during the week of March 13, 2017. The first exercise involved a hazardous materials (HAZMAT) response for a burning railcar at the Union Pacific railyard in Santa Teresa, NM. CMAD provided a land-based plume generator that allowed the CST to test its AreaRae air monitoring equipment and HAZMAT identification procedures.

The second exercise was a response to a booby-trapped vehicle parked at the City of Sunland Park Sports Complex in NM. CMAD provided the chemical warfare agent surrogate for the exercise. Samples were collected, split, and analyzed by both CST's mobile Advanced Weapons Laboratory trucks and CMAD's Portable High-Throughput Integrated Laboratory Identification System (PHILIS) mobile laboratory. Sample handling, chain-of-custody, analytical standard operating procedures (SOP), and data-sharing protocols were tested and evaluated between the two laboratories. EPA Region 6 OSC Pratistha Adams was on-hand to observe CMAD capabilities and evaluate the joint exercise.

73rd Weapons of Mass Destruction (WMD) CST Clandestine Laboratory Identification Training

At the request of EPA Region 7 OSC Doug Ferguson, CMAD supported a clandestine laboratory identification training course developed for the 73rd WMD CST (March 6 through 10, 2017). The course was taught by EPA Region 7, CMAD, Kansas Bureau of Investigation, and U.S. Bureau of Alcohol Tobacco and Firearms staff. In addition to CST members, attendees included representatives of the Department of Homeland Security (DHS) and state and local fire and police department participants.

The three-and-a-half-day course included lectures describing four general categories of clandestine laboratories: chemical warfare, biological warfare, radiological agent, and illicit drug laboratories. The course included hands-on exercises using mock laboratories. CMAD personnel lectured on chemical weapons synthesis, biological weapon production, and toxin purification techniques, and assisted with setting up the mock laboratories.

Using the knowledge gained from their lectures, students entered the mock laboratories and used hand-held detection equipment to identify and classify materials from each of the four clandestine laboratory categories. As a final challenge, teams of students constructed their own mock-up laboratories for the other teams to identify. In addition to the formal training, the students benefitted from the opportunity to exchange ideas, experiences, and technical knowledge.

RTFL Annual Refresher Training Events

RTFLs participated in two annual refresher training events in Las Vegas, NV (May 23 through 25, 2017) and Erlanger, KY (June 27 through 29, 2017). CMAD, Environmental Response Team (ERT), Radiological Emergency Response Team (RERT) and EPA Region 1 instructors taught the course, which focused on the use of radiation detection equipment. A dozen RTFLs attended both training events. Each training event was evenly split between classroom instruction and field activities. Classroom topics included a refresher course on health physics principles and detection equipment use. For the field activities, teams of RTFLs made entries into a simulated residence

continued on page 3 column 2


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OSC Academy 2018

CMAD once again offered CBRN-specific topics at the 2018 OSC Academy. CMAD provided a focused curriculum during the Academy with half-day courses on specific topics related to chemical warfare agent (CWA) response, biological agent response, and radiological/nuclear response instead of delivering a "track-style" curriculum as it had in the past. The courses focused on aspects that make CBRN response unique and challenging due to either the agent or contaminant of concern or due to the authorities involved.

CMAD worked with OSCs across the country to develop a curriculum that not only delivered information on the current state of the science but that also addressed the needs of EPA's response community. Lecturers included CMAD staff, OSCs, and researchers from the EPA Office of Research and Development (ORD) National Homeland Security Research Center (NHSRC). In addition to lectures, several case studies were presented to foster conversation amongst the audience, and one course offered a tabletop exercise to demonstrate how course materials could apply in a real-world scenario.

The CBRN courses were appropriate for both new and seasoned OSCs who had not had extensive experience with CBRN incidents. OSCs interested in working with CMAD on developing training for next year's Academy and in other settings should contact Mike Nalipinski, CBRN CMAD Associate Director, at nalipinski.mike@epa.gov.

A EPA Region 1 OSC Cathy Young teaching CWA Preparedness at the OSC Academy.

B RSP training customers.

C Rad training using CMAD RSP sources.

D CMAD RSP deployments.

continued from page 2

containing various radioactive items that they had to identify and describe. During an all-day outing, RTFLs also conducted soil, water, and sediment sampling and GPS orienteering. A facility walk-through at a fish hatchery provided opportunities to discuss possible impacts and sampling strategies related to an intentional contamination event. In addition, case study descriptions of the events at Chernobyl, Fukushima, and Goiania allowed discussion about large-scale, real-world events. CMAD plans to continue support of the RTFL Program and will conduct annual RTFL training in Fiscal Year (FY) 18.

Evaluation of Potential Response Impacts of National Bio and Agro-Defense Facility (NBAF)

At the request of EPA Region 7, CMAD accompanied OSC Eric Nold to visit the future site of the NBAF, which is being constructed on the Kansas State University campus in Manhattan, KS. NBAF, a DHS facility, is slated to replace the Plum Island, NY facility as the premier research facility for agricultural biodefense. Construction of the facility is ongoing, and the NBAF is slated to be operational in 2022.

NBAF will be the home of high-risk research on some of the rarest and most dangerous agricultural and zoonotic diseases. The facility will have both Biosafety Level (BSL)-3 and BSL-4 laboratory spaces, the two highest levels of safety requirements for biological research. The facility will focus its research on diagnostics, training, vaccine development, biological countermeasures, and applied research.

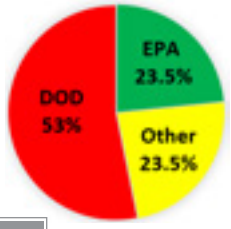
Although the NBAF will not be operational for years, EPA Region 7 is proactively working with officials from the DHS, U.S. Department of Agriculture (USDA), Centers for Disease Control and Prevention (CDC), and several state and local partners to create working relationships, with the goal of developing a preparedness and response framework for the facility. Although the DHS is confident in its ability to keep pathogens "inside the fence line" of the facility, it is critical to ensure that all the stakeholders are aware of the roles and responsibilities of response agencies in the unlikely event of a pathogen release from the NBAF. EPA Region 7 is in the early stages of evaluating potential facility-related risks and in determining how the RRT would react to a pathogen release. CMAD will continue to assist EPA Region 7 and the RRT to ensure that response plans reflect the current state of the science with regard to biological response and decontamination.

Radiological Source Program (RSP)

CMAD's RSP supports radiological training and exercises by using materials licensed by the Nuclear Regulatory Commission. The license authorizes the use of the RSP's sealed radiation sources for (1) calibration, (2) field exercises and demonstrations, and (3) teaching and training individuals conducting civil defense activities anywhere in the United States. The federal RSP program allows trainees to experience safe but elevated radiation environments in the field with our sources with strengths that range from unlicensed microCurie "button" alpha, beta, and gamma sources to licensed milliCurie gamma (Cobalt-60, Cesium-137, Barium-133) and Curie neutron (Americium-beryllium) sources. Trainees no longer must travel to unfamiliar fixed training locations just to exercise with licensed radiological materials, personnel can instead train and exercise in response protocols in a local setting where more trainees can participate and observe the activities.

CMAD provides a "turn-key" solution to the challenge of training in a radioactive environment. The RSP handles all logistics associated with health and safety, shipment and handling, and temporary storage. Trainees are responsible for providing their own dosimetry equipment (if required) and may be asked to help coordinate efforts to authorize access to certain DoD facilities.

The RSP has interagency agreements with the Federal Emergency Management Agency (FEMA) and the U.S. Army North, which have become regular RSP customers and were responsible for the continued growth of this program in 2017. For assistance in developing a radiological training exercise or to include RSP resources in existing radiological training or exercises, contact Captain John Cardarelli II, Radiation Safety Officer, at cardarelli.john@epa.gov.



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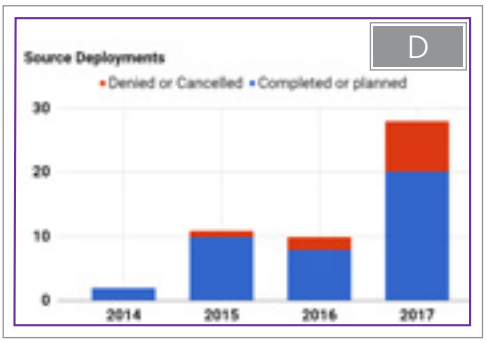

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CBRN National Preparedness Workgroup Updates

Several national workgroups have been established to enhance the emergency response planning, preparedness, and technical capabilities of EPA's emergency response for chemical, biological, and radiological incidents. CMAD assembled highly experienced and technical groups of regional OSCs, special teams, EPA Headquarters staff, and ORD personnel to provide cross-regional coordination and to share information, provide reach-back support, standardize procedures, evaluate equipment and the interoperability of equipment, and ensure national consistency.

The Chemical Warfare Agent Preparedness Workgroup (CWAPWG) continues to address the needs and concerns of EPA's response community, communicating through monthly conference calls, webinars, and face-to-face meetings held throughout the year. In early 2017, the CWAPWG established four separate sub-workgroups to address specific CWA technical and operational needs. The four sub-workgroups are Sampling & Analysis, Decon & Clearance, Waste Management, and Health & Safety. In addition to the monthly CWAPWG calls, the sub-workgroups are working to identify CWA gaps and solutions for filling them, developing SOP and guides, and white papers on specific issues. The CWAPWG has updated its charter and membership, and welcomes EPA Region 7 OSC Doug Ferguson as the new Regional Co-Coordinator, and EPA Region 1 Ted Bazenas as the Removal Manager.

The National Biological Preparedness Workgroup has been developing the foundation for providing consistent, high-quality products to the OSC community. The group recently accepted an updated charter memorializing the commitment from all 10 EPA regions to support the group's work. Additionally, EPA Region 3 OSC Don McLaughlin accepted the position as Regional Co-Coordinator for the group, and EPA Region 5's Mark Durno will continue on as the Removal Manager. CMAD, with this regional support and leadership, will help chart a path forward to enhance OSC readiness in response to a biological agent incident. The group will update the Comprehensive Biological Response Guide, develop an abridged version of the guide, and develop a small tear sheet with critical references for use during a biological agent incident. Additionally, small sub-workgroups have been developed to tackle issues related to the DHS BioWatch Program and EPA's medical countermeasures policy.

The National Radiation Preparedness Group (NRPG) also continues to hold monthly calls that allow agency-wide discussions regarding topics related to emergency responses involving the real or potential releases of radioactive materials. The NRPG currently is addressing the creation of a plan that meets Emergency Support Function (ESF)-10 response needs for a radioactive material release. Three sub-workgroups address various aspects of this large endeavor. One group is considering decontamination methods and technologies appropriate for recommendation. Another group is discussing strategies to implement. The third group is determining Incident Command (IC) system structures most useful for a radiation-oriented response. Other topics under discussion by the NRPG include an up-to-date inventory of radiation response assets across EPA regions and special teams, RTFL and other radiation-related training opportunities, upcoming exercises, and desired updates to the Radiation Operational Guide.

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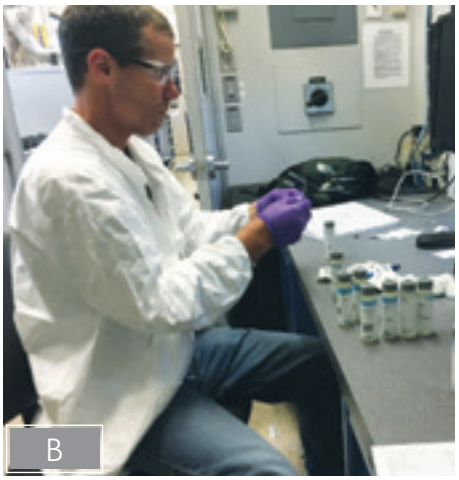

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REGIONAL SUPPORT

A Fentanyl.

B PHILIS sample management.

C Orphan container recovery branch member in waders checking weight and contents of a drum as part of the Hurricane Harvey response.

D Demonstrating EPA's air monitoring equipment to U.S. Army Corps of Engineers during hurricane response.

E Map showing air sampling locations.

Technical Working Group (TWG) Support in EPA Region 10

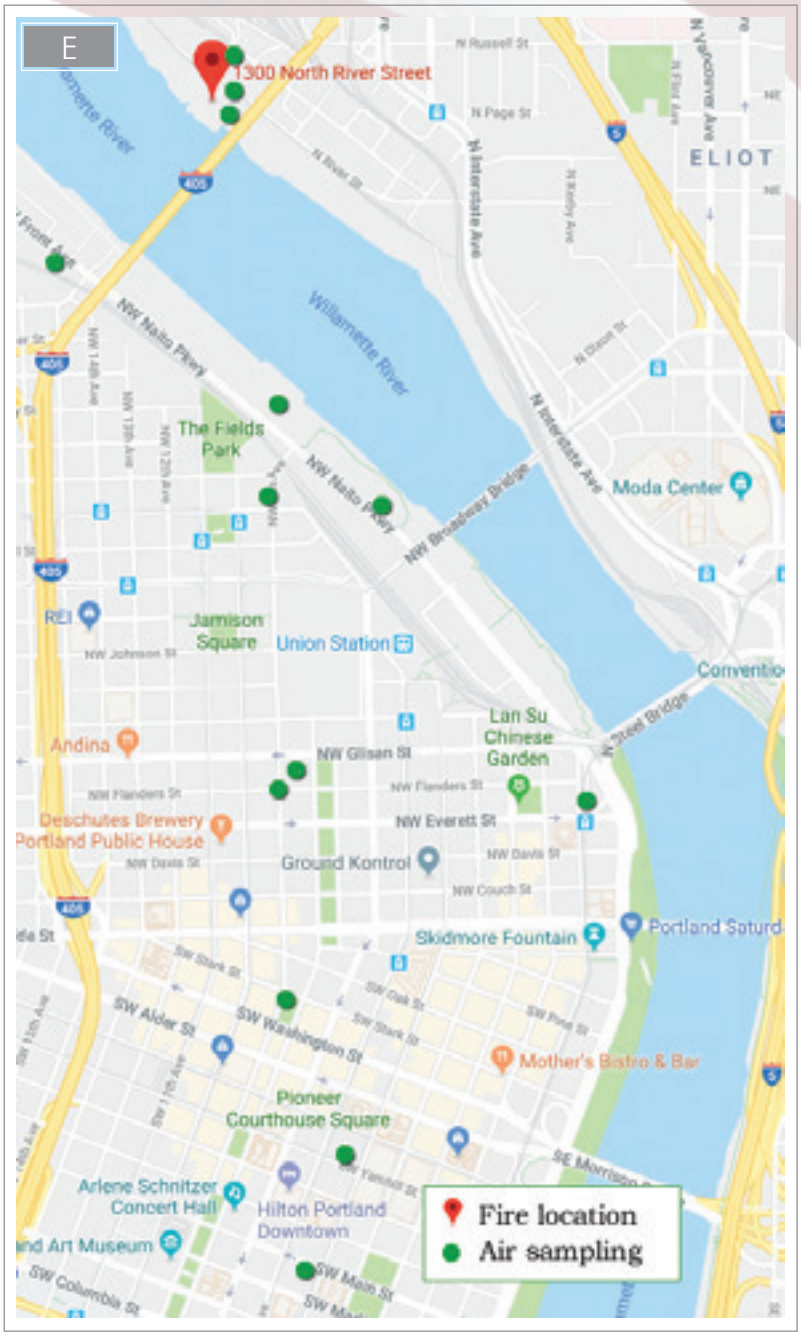
On May 14, 2017, a warehouse fire occurred on the north side of the Willamette River in northeast Portland, OR. The warehouse was constructed using asbestos-containing material (ACM). Wind-blown ash and debris dispersed in an area southwest of the Willamette River measuring approximately 3 miles long and 1 mile wide and covering much of downtown Portland. The densely populated dispersion area is residential and mostly contains multi-story buildings, with approximately 311,000 people living in and commuting to the area. ACM debris impacted two large high-rise condominiums with approximately 180 units each downwind from the fire. The ACM was dispersed on the buildings' balconies, roofs, and common spaces as well as on other commercial buildings.

On May 23, 2017, EPA Region 10 OSCs Eric Vanderboom (Operations Section Chief) and Mike Boykin (Environmental Unit Leader) contacted the CMAD After Hours Watch Officer (AHWO) requesting assistance in developing a sampling and analysis plan and to determine if sampling roof-top heating, ventilation, and air conditioning (HVAC) filters could indicate if the interior of a building may contain ACM from the warehouse fire.

The AHWO contacted subject matter experts (SME) and formed an *ad hoc* TWG consisting of a CMAD HVAC engineer, ORD ACM expert, NHSRC staff member who developed and implemented HVAC sampling in subway cars, and a Safety Officer. Additional SMEs from the National Enforcement Investigation Center and from EPA Region 2 were approached because they had sampling experience in New York City after the 9/11 World Trade Center terrorist attack.

Based on technical discussions and field observations, the TWG concluded that "there is little utility in sampling the roof top building HVAC filters and making any significant technical conclusions regarding if ACM from the warehouse fire entered the building through the air handling system based on one data point." The major reason for this conclusion was due to the variability of the HVAC filter design efficiencies. Dirt and debris loading of the filters would impact the filter efficiency, and also air could be leaking around the housing of the filters. The TWG was disbanded on May 25, 2017, after the Incident Management Team received, evaluated, and accepted the conclusions of the TWG.

This incident highlights CMAD's ability to apply tactical experience (in this case, HVAC filter sampling developed during biological-agent subway studies) to a non-CBRN incident. CMAD did not deploy assets or staff to the field but instead was used effectively in a reach-back capacity to address an emerging technical issue during a large incident with national media coverage.



A Airborne IR imagery of storage trailers at Arkema plant.

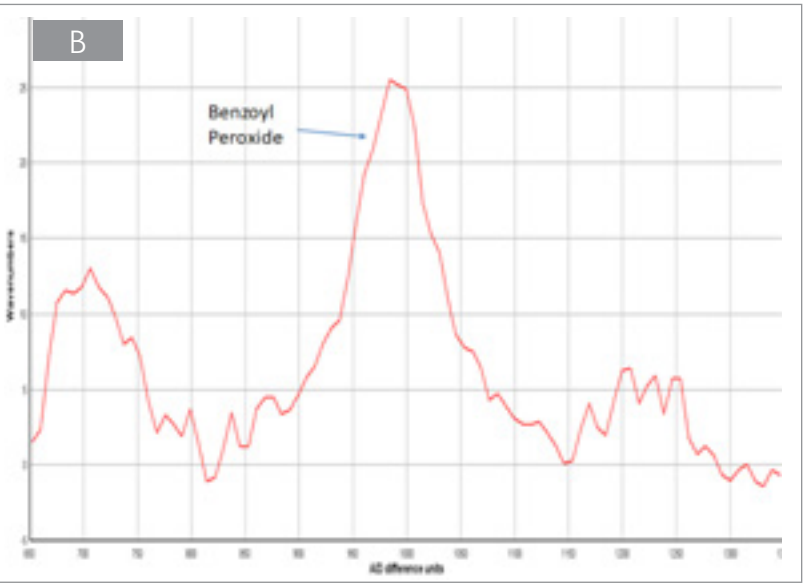
B IR spectrum of benzoyl peroxide vapors emitted from Arkema plant due to combustion.

C PHILIS analytical support.

Support for EPA Region 6 Hurricane Harvey Response

After Hurricane Harvey, the EPA Region 6 Emergency Operations Center (EOC) requested CMAD personnel and mobile assets to support response efforts. The request included on-site analytical support using the PHILIS mobile laboratory, activation of the Airborne Spectral Photometric Environmental Collection Technology (ASPECT) aircraft, and mobilization of field operations staff.

On August 30, 2017, ASPECT responded to an explosion at the Arkema plant in Crosby, TX. Hurricane Harvey compromised the plant's on-site refrigeration system used to produce and store liquid organic peroxides. As these peroxides warmed, the compounds became unstable and eventually ignited into high-intensity fires. The ASPECT aircraft conducted a number of data collection missions over the plant and provided EPA Region 6 with timely situational data, including remote-sensed chemical identification data, airborne infrared (IR) imagery, and aerial photographs. Of critical importance to EPA Region 6 and other response officials was determining if hazardous chemical vapors from the plant were impacting the surrounding population. IR spectra data showed low concentrations (5 parts per million) of peroxide emissions generated after the chemicals reacted. These data were extracted from the aircraft in near real-time using an airborne satellite communication system and provided to EPA Region 6 as actionable data.



In addition, due to probable flooding at the plant, all peroxides had been moved from the plant's refrigerated storage area to on-site trailers with refrigerated storage. The ASPECT aircraft collected and used IR imagery to remotely determine the relative temperatures of these trailers.

Finally, throughout the monitoring mission, the ASPECT aircraft collected high-resolution aerial and oblique photographs that were transmitted to EPA Region 6 to allow timely awareness of the situation.

The ASPECT mission soon converted from Emergency Response to Rapid Needs Assessment (RNA) and remained in this mode until completion of the deployment. The core of the mission consisted of the collection of both high-resolution photographs and remote chemical sensing data over sites impacted by the hurricane. In general, these sites included water treatment, wastewater treatment, and risk management plan (RMP) facilities. RMP facilities store hazardous chemicals on site. The overall data set consisted of 3,064 high-resolution aerial photographs, 786 oblique photographs, and over 2.4 million chemical data points.

On August 31, 2017, CMAD also deployed PHILIS mobile analytical and sample preparation trailers to Houston, TX. The trailers were stationed at the EPA Region 6 laboratory in Houston. Early on, the trailers were the only environmental laboratories staffed and operational in the area. The PHILIS laboratories were configured to analyze for volatile organic coumpounds (VOCs) and semi-volatile organic compounds (SVOCs) using SW-846 Methods 8260 and 8270, respectively.

CMAD provided preliminary PHILIS results to the EPA Region 6 IC and Environmental Unit (EU) within 24 hours of receipt. Scribe electronic data deliverable (EDD) and preliminary PHILIS results were provided to the EU daily. The Tier 2 data package was provided 24 hours after the PHILIS preliminary results, and a final Contract Laboratory Program (CLP)-reviewable data package was provided within 10 days. Initially, the PHILIS laboratories analyzed surface water samples collected from the site of the Arkema chemical plant fire. Later, PHILIS laboratories analyzed water, soil, and sediment samples from several Superfund sites impacted by Hurricane Harvey for VOCs and SVOCs. During the EPA Region 6 deployment, PHILIS laboratories ran over 60 separate analyses.

CMAD provided additional assistance during the response by sending two field staff to aid EPA Region 6's Bravo Branch of the Hurricane Harvey Incident Command Post (ICP) at the Houston-Galveston Sector Coast Guard building. Initial support tasks included oversight of the preparation of the orphan container collection area. This effort involved establishing a traffic plan, a site map, perimeter assessment, and emergency egress routes. After the collection area was built, one staff member continued collection area oversight and the other member conducted orphan container recovery activities.

The orphan container recovery branch fielded as many as six teams in boats and government-operated vehicles. These teams responded to locations previously identified by Hazard Evaluation teams who documented containers and other items needing recovery. Over 2 weeks, Bravo Branch teams working consecutive 12-hour days collected over 500 containers. In addition, some leaking containers were either recovered and sealed or referred to local HAZMAT teams for further action. By the end of the 2 weeks, over 100 locations had been visited, some yielding as many as 20 recoverable items.

Many items were small gas cans or leaking drums, but several 500-gallon propane tanks also were recovered as well as a few larger items, most notably a 2,500-gallon polyethylene tank that had floated into a residential yard. The tank required additional assessment, reduction, and containerization for removal.

D Orphan drum being overpacked during Hurricane Harvey response.

E Full propane tank from a residence with other debris.

A Fentanyl.

B Fentanyl crystals and pills.
Source: U.S. Department of Justice Drug Enforcement Administration.

C A lethal dose of fentanyl for most - 2 milligrams.
Source: U.S. Department of Justice Drug Enforcement Administration.

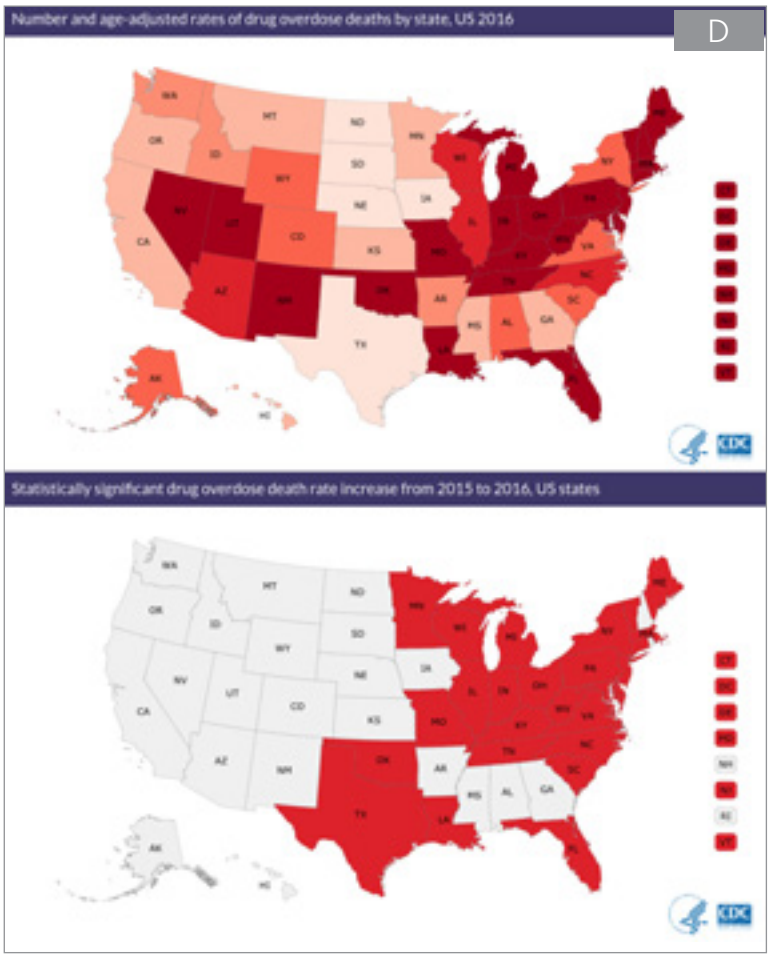
D Spread of fentanyl use in the United States from 2015 to 2016.
Source: Centers for Disease Control and Prevention.

E Fentanyl cutting table.
Source: U.S. Department of Justice Drug Enforcement Administration.

CMAD Support to EPA Regional OSCs – Fentanyl Fact Sheet

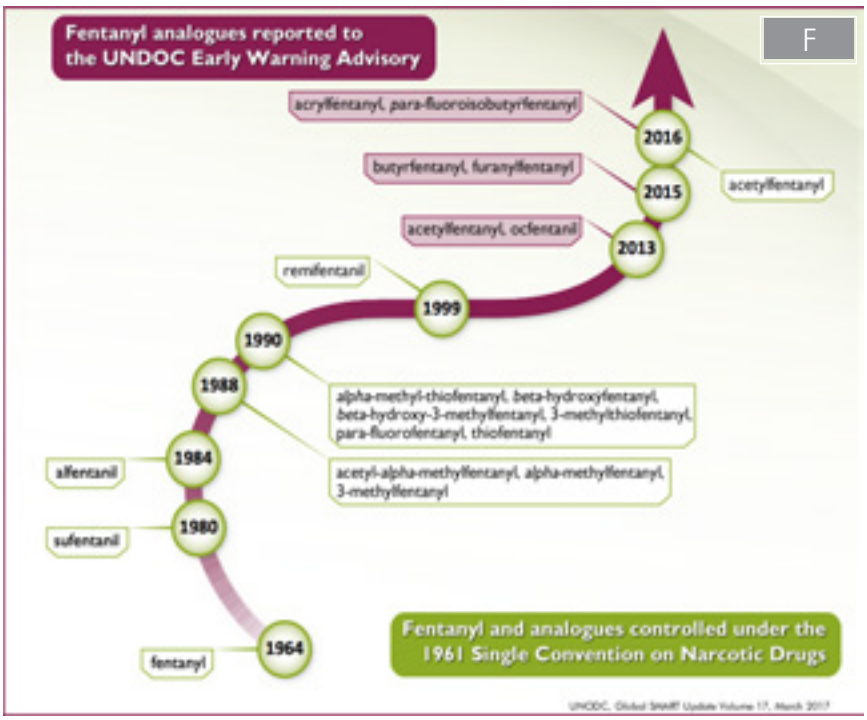
In Fall 2016, OSCs from EPA Regions 3, 4, 5, 8, and 9 began receiving inquiries from local HAZMAT response partners, law enforcement agencies, and Emergency Medical Services (EMS) teams regarding health and safety issues and decontamination options for incidents involving fentanyl, its analogs, and other synthetic opioids. These OSCs in turn reached out to CMAD to request the development of a fentanyl fact sheet for OSCs to use when asked for assistance from local responders.

EPA has not yet been requested to respond to an actual opioid incident, but given the explosion of opioid use and abuse in the nation, such a response likely will be required in time. The White House recently declared a "National Opioid Crisis" and is ramping up federal assets to combat the spread and effect of opioids on the nation.



EPA's roles and responsibilities during an opioid response are still unclear, but CMAD wanted to ensure that the EPA is prepared to safely and effectively respond to an opioid incident if called upon for action. To address this possibility, CMAD formed a work group that consisted of: state and local first responders; EMS and law enforcement teams; two state Health Departments; and other EPA partners (including OSCs, the National Counterterrorism Evidence Response Team, ERT, and the NHSRC). The work group developed a "Fentanyl Fact Sheet for OSCs" to address response-related issues associated with incidents or sites contaminated with the fentanyl class of opioid compounds. CMAD held several work group conference calls throughout 2017 and followed up with webinars and briefings for several EPA regions, typically during the monthly OSC training sessions.

The Fentanyl Fact Sheet consists of the 12 sections (*see right for listing*) and is intended to be a "living" document, with updates provided as the science and methods for opioid response evolve.



Fentanyl Fact Sheet

Fentanyl and fentanyl analog characteristics

Physical properties

Potential exposure pathways (includes Provisional Advisory Levels and Occupational Exposure Limits)

Personal safety

Personal protective equipment (PPE)

Field detection

Sampling

Analysis

Decontamination and cleanup

Personnel decontamination

Waste management

References

Points of contact for the fact sheet are Larry Kaelin at (513) 675-4751 and Mike Nalipinski at (617) 918-1268.

F Controlled fentanyl and analogues.

G Prescription fentanyl.

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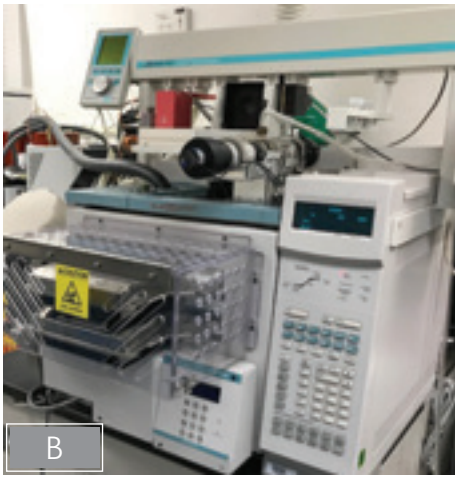

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PHILIS

Portable High-throughput Integrated Laboratory Identification System

A Chemox injection trailer, Mackenzie Site.

B PHILIS Time of Flight gas chromatograph mass spectrometer (GCMS).

C PHILIS sample storage.

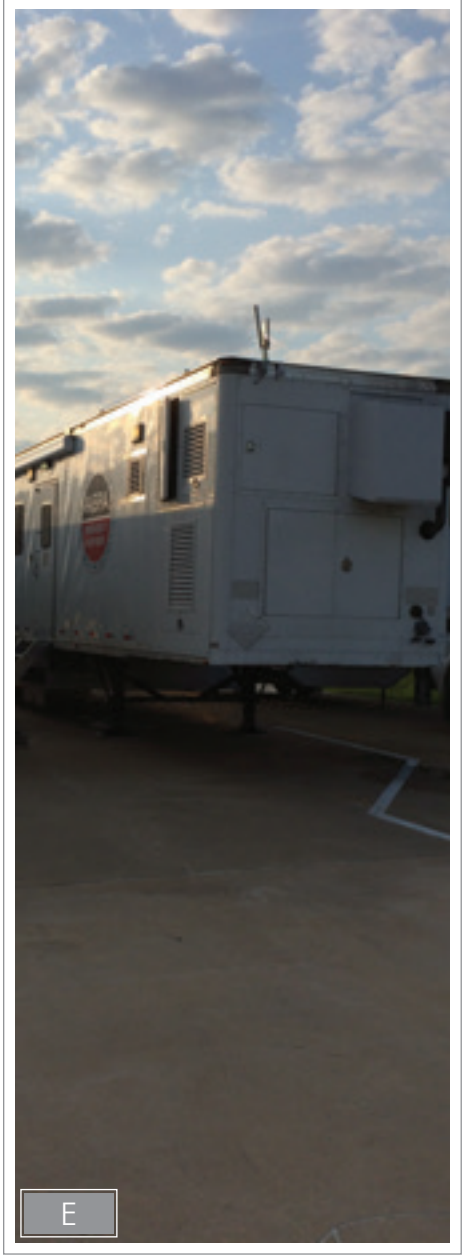
D PHILIS Laboratory Unit for trace level CWA.

E PHILIS Mobile laboratory in EPA Region 6, just one of many deployments.

F Sample collection on the Potomac River.

The PHILIS units are EPA's mobile laboratory assets for on-site or remote analysis needed for response to natural disasters, accidental releases, terrorist attacks, and other incidents. The PHILIS system can analyze soil, water, surface wipe, and air samples for CWAs. The PHILIS system is certified by the National Environmental Laboratory Accreditation Program (NELAP) to analyze for VOCs, SVOCs, and polychlorinated biphenyls (PCBs). Currently, PHILIS is undergoing certification under the DoD ELAP for CWAs.

PHILIS assets can be mobilized to participate in regional EPA field exercises, interagency exercises, and ongoing Environmental Response Laboratory Network (ERLN) method validation studies. At the request of EPA regional OSCs and Remedial Project Managers (RPMs), PHILIS assets have been deployed to several Superfund and Removal sites to perform on-site environmental analyses. Examples of PHILIS laboratory support activities are provided below.



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EPA Region 3 Potomac River Sheen Discharge Incident

On December 1, 2016, EPA Region 3 OSCs Jack Kelly and Charlie Fitzsimmons contacted CMAD to provide on-site analytical support using the PHILIS mobile laboratory assets for the Potomac River Sheen Discharge incident in Dickerson, MD. The PHILIS mobile laboratory assets deployed to the Daleclaria Water Treatment Plant in northwest Washington, DC, and set up to analyze water samples collected from the Potomac River in an area ranging from Montgomery County, MD to Fairfax County, VA. Attempts were made to collect samples from surface water with visible sheen as well as lower water-column samples.

As requested by the EPA Region 3 Environmental Unit (EU), samples were analyzed under screening protocols in accordance with EPA SW-846 Method 8270 guidance for identifiable oil product and for naphthalene, phenanthrene, fluoranthene, and pyrene. Additionally, a spectral library search was performed for each analysis for any other tentatively identified compounds deemed "of interest" by the EU. The determination of tentatively identified compounds would later turn out to be an important factor in identifying the source of the sheen. Over 7 days, approximately 100 samples were analyzed, with a less than 24-hour turn-around time for preliminary results, including the library search for tentatively identified compounds.

continued on page 13 column 2

F

A Oil sheen with collection boom.

continued from page 12

A separate sample of an oily material collected at a water outfall at a nearby power plant was analyzed along with the surface water samples.

The analysis and search for tentatively identified compounds indicated a phenolic compound, a few isolated aliphatic hydrocarbons, and a noticeable "hydrocarbon hump" ranging from C-19 (a hydrocarbon containing 19 carbon atoms and 40 hydrogen atoms) to approximately C-45. CMAD reported to the EU that this type of hydrocarbon hump is consistent with that of a lubricating oil and not a fuel spill. The U.S. Coast Guard (USCG) laboratory in Connecticut analyzed the same oil sample and also identified the hydrocarbon product as a lubricating oil. The EPA Region 3 laboratory in Fort Meade, MD, analyzed a water sample containing the sheen and yielded results with a hydrocarbon hump similar to the oily material collected at the power plant outfall. The PHILIS, USCG, and EPA Region 3 laboratory results all provided good evidence that the sheen was from a release at the power plant outfall.

After evaluation of the results and discussion with Region 3 EPA, state and local water authorities, and power plant staff, the power plant accepted responsibility for the discharge into the Potomac River. Fortunately, the quick response of local water authorities avoided adverse impacts on drinking water facilities along the Potomac River. The sheen dissipated quickly, and the source of the discharge remediated, with no interruption in service to the public.

EPA Region 5 Allegan Metal Finishing Site

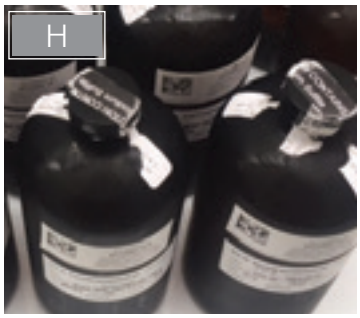
In August 2017, EPA Region 5 OSC Andrew Kocher requested CMAD analytical support at the Allegan Metal Finishing site in Allegan, MI. CMAD analyzed residential well water and groundwater samples for VOCs using Drinking Water Method 524.2 and for SVOCs using SW-846 Method 8270. A total of 22 samples were sent to the PHILIS laboratory assets in Edison, NJ, which provided analytical support in "stationary mode" (i.e., PHILIS did not mobilize to MI). CMAD submitted the Scribe compatible EDD files and preliminary results within 24-hours of sample receipt, and Tier 2 data packages and a final CLP-reviewable data package were sent to OSC Kocher within 10 days.

B Demolition of Mackenzie Chemical Works (4/27/2004).

C Debris at the Mackenzie Chemical Works site.

EPA Region 2 Mackenzie Chemical Works Site

EPA Region 2 OSC Lou DiGuardia, requested analytical support from CMAD at the Mackenzie Chemical Works site in Central Islip, NY. During the years between 1948 and 1987, the facility actively produced various chemicals, fuel additives, and 1,2,3-trichloropropane (the contaminant of concern in the site cleanup). In September 2017, more than 40 soil samples were sent by courier to the PHILIS laboratory asset in Edison, where they were analyzed in "stationary mode" for VOCs using SW-846 Method 8260. Within 24 hours of sample receipt, CMAD submitted the Scribe-compatible EDD files to the OSC, along with preliminary results. Tier 2 data packages were delivered 24 hours after the preliminary results, and a final CLP-reviewable data package was sent to EPA Region 2 within 10 days.



U.S. Army Pueblo Chemical Army Depot (PCAD)

In Summer 2017, the DoD's Chemical Material Agency (CMA) contacted CMAD to request air monitoring and analytical support during the clearance of the PCAD bunkers used to store munitions containing sulfur mustard (HD). The CMA provided its laboratory protocols to enable the PHILIS mobile laboratories to be accredited as "DoD-compliant." PHILIS staff conducted precision and accuracy studies following CMA protocols and using current EPA ERLN Ultra-dilute Chemical Agent Program standards. A total of 192 determinations were made using a modified TO-17 method for VOC air analysis for HD.

Once accredited, PHILIS will be the first, and probably only, EPA laboratory to be designated as DoD-compliant. PHILIS laboratories then will be able to accept the DoD CMA's Research, Development, Testing and Evaluation-level standards (also called "CASARM standards"). This accreditation will be in addition to the current PHILIS laboratory designation as CWA-compliant under EPA's ERLN. As such, the PHILIS laboratories can accept standards from both DoD CMA and EPA ERLN sources. The PHILIS mobile laboratories are scheduled to provide analytical support to the PCAD during the upcoming decommissioning of historical munitions bunkers starting in Summer 2018.

D — Tanker containing sodium persulfate for injection activities at the Mackensie site.

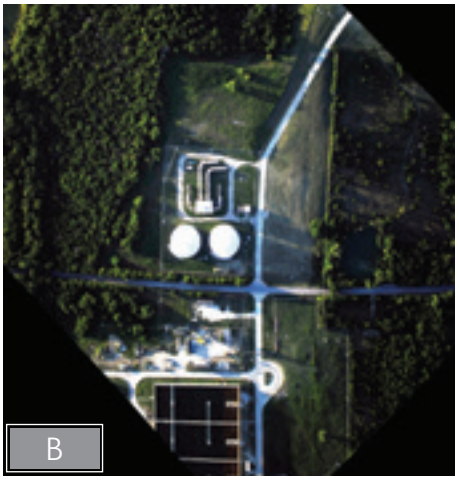
E — Piping for Chemox injection at the Mackenzie site.

F — Mackenzie soil vapor extraction system.

G — Allegan samples in process.

H — Allegan Sample bottles with Chain of Custody labels.

A



B

C

D

ASPECT

Airborne Spectral Photometric Environmental Collection Technology

A New ASPECT LS1600 IR line scanner.

B High-resolution image of Plano, TX, ammonia release.

C ASPECT aircraft nose cone.

D ASPECT aircraft.

EPA's ASPECT aircraft is a near real-time, remote radiological and chemical detection, IR and photographic imagery airborne platform. ASPECT commonly deploys to detect and assist in mitigating multiple hazards at major U.S. events and provides a critical operational response capability in support of hazardous incident response and recovery missions. ASPECT can provide secure information to the first responder incident commander that is timely, actionable, and compatible with numerous software applications. Its products can be provided to responders within minutes to hours, depending on mission parameters. The ASPECT team of scientists and engineers provides on-site support to first responders, performs data analyses, and continues to improve detection technology. ASPECT's planned future capabilities and an example of its deployment are discussed below.

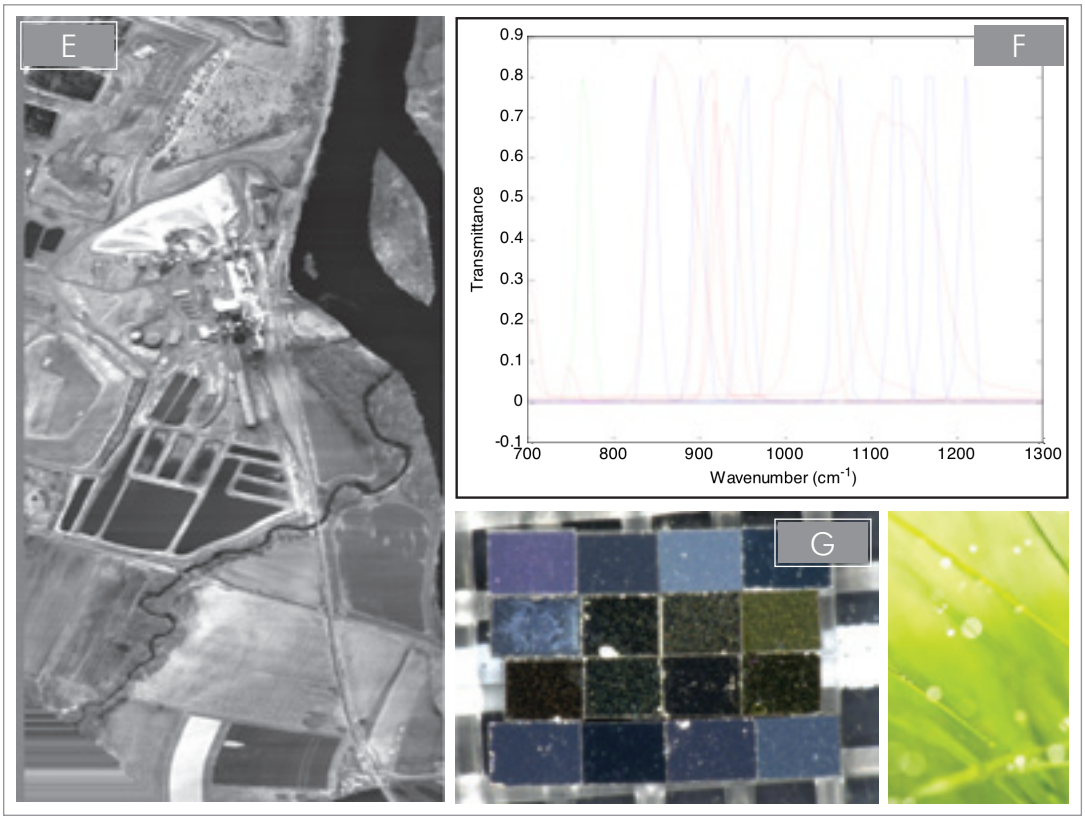
The New LS1600 IR Line Scanner

The new LS1600 IR line scanner highlighted in the FY 2016 annual report is expected to be fully operational by the end of April 2018. The scanner is a self-contained, multi-channel IR system generating a 1,000-meter-wide image in real-time.

The sensor builds on the track record of the current RS800 line scanner by incorporating a custom set of 16 cold optical filters positioned on top of a 16-channel, long-wave, four-by-four Mercury Cadmium Telluride detector array. The individual optical filter elements are approximately 100 micrometers on a side configured in a checkerboard arrangement.

The spectral response of the filter assembly has been designed to act as a low-resolution spectrometer permitting chemical detection using a pattern recognition methodology. Implementation of the pattern recognition methodology requires a high degree of "out-of-band signal attenuation."

On March 23, 2017, the LS1600 IR line scanner was flight-tested to evaluate basic detector operation, data acquisition throughput, and mechanical stability. This test was successful and generated high-quality monochrome imagery. The system is being refined, with a forecasted final test flight scheduled for April 23, 2018.



E

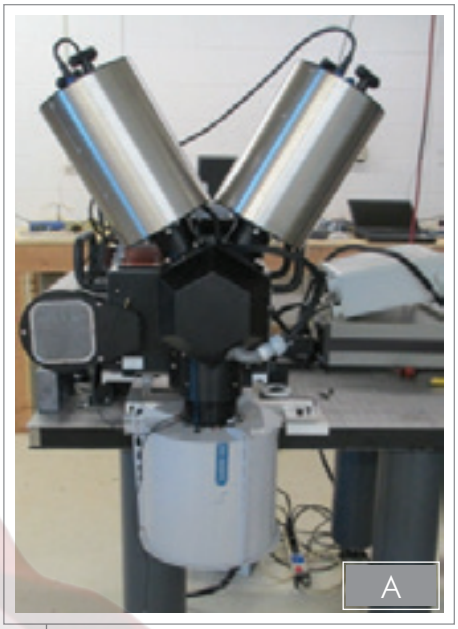
LS1600 IR line scanner monochrome image – March 23, 2017.

F

Cold optical filter array response curves showing excellent response, with better than 40 dB (1%) out-of-band attenuation.

G

Cold optical filter array.



A VSR system.

Versatile SpectroRadiometer (VSR)

The ASPECT team is in the final phases of preparing the VSR system for full-time service as the program's airborne Fourier Transform Infrared Spectrometer (FTIR). The VSR will serve as the principle system for both chemical identification and remote plume concentration estimation.

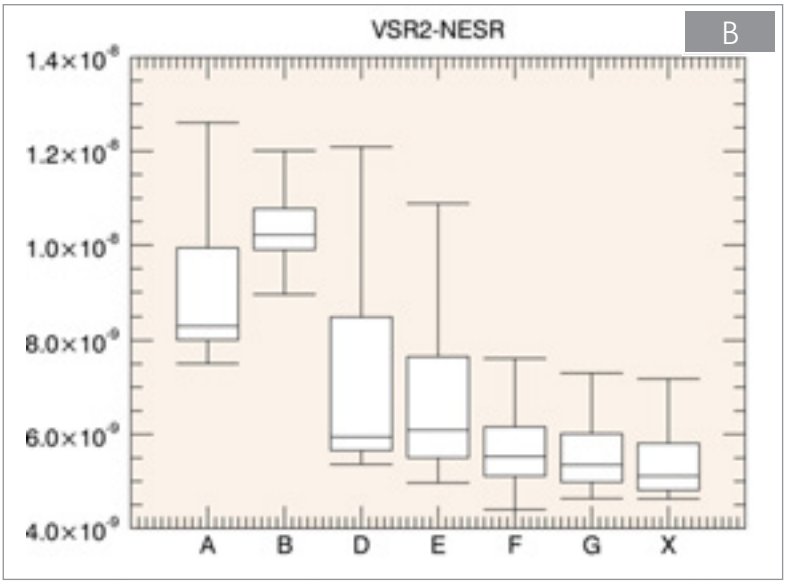
As with the LS1600 IR line scanner, the VSR uses a pattern recognition methodology incorporating a multi-dimensional data discrimination technique called piecewise linear discriminant analysis (PLDA).

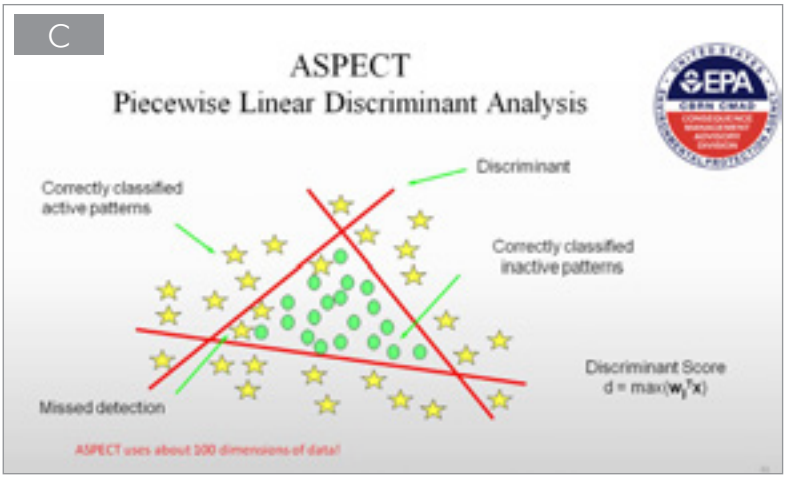
A key requirement for PLDA to function properly is a low-noise figure intrinsic to the collection system. Work by the ASPECT team has resulted in a noise figure, depicted as a noise equivalent spectral radiance, 20% lower than that of the current airborne MR254AB FTIR. A lower noise figure typically results in a lower (improved) detection limit, a meaningful improvement for a remote sensing emergency response program like ASPECT.

In addition to a superior noise figure, the VSR system also is equipped with bracketing blackbody units permitting full radiometric calibration to the collected data. The radiometrically calibrated data will in turn permit near real-time generation of concentration data for chemical vapor plumes. Flight-testing and full implementation of the sensor is anticipated by the Spring of 2018.

B Noise history of the VSR (lower number indicates lower noise level).

C Piecewise linear discriminant analysis.





Region 6 page 18

D High-resolution image of Plano, TX, ammonia release.

E Round points are ammonia detection locations; blue and green lines are aircraft flight paths.

F IR signature of ammonia vapor.

G Release point of ammonia release in Plano, TX.

H Weak ammonia plume (red area).

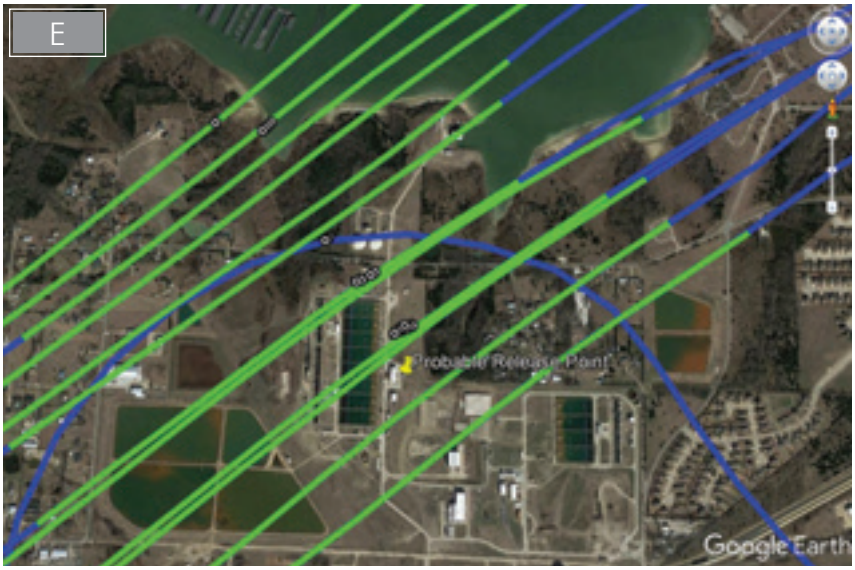
EPA Region 6 Ammonia Release

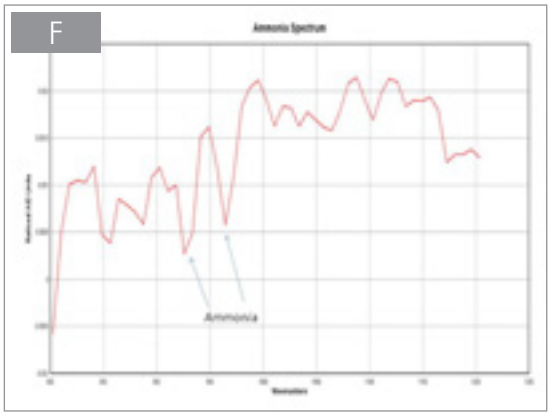
On July 20, 2017, EPA Region 6 OSC Brandi Todd requested that the ASPECT team and aircraft be mobilized to support air monitoring activities for an ammonia release at the wastewater treatment plant in Plano, TX. The team used the full complement of ASPECT sensors to (1) confirm that ammonia was leaking from the facility, (2) provide an estimation of the ammonia vapor concentration, and (3) generate an image of the resulting plume.

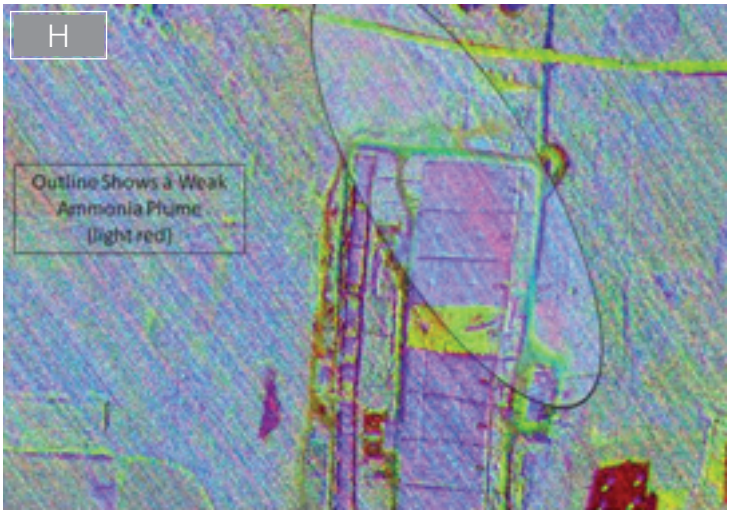
Ammonia has a very distinct IR signature, which was coupled with a background suppressed pattern recognition method and used to accurately detect the presence of ammonia vapor.

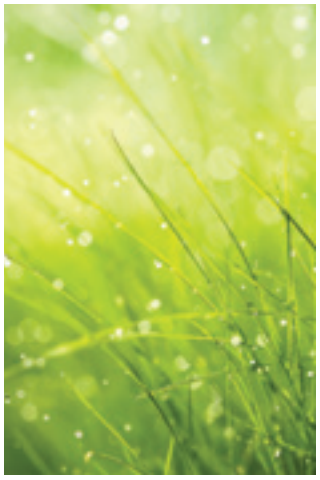
Mapping of the entire plume was made possible by using a second IR sensor, the RS800 multispectral line scanner, to image the plume using a cold optical filtering technology.

Finally, a real-world frame of reference was generated by collecting aerial photographs of the site simultaneously with collection of the chemical data. Aerial photographs were generated using a high-resolution mapping camera recently installed in the ASPECT aircraft.









UTR PROJECT

Underground Transport Restoration Project 2014-2017 Summary Report

A Retrieving air samples during NYC Phenomenology Study.

B Waste sample collection during UTR-Operational Technology Demonstration.

C CMAD preparing rail car during Methyl Bromide fumigation study.

D DHS conducts release for UTR study in NYC.

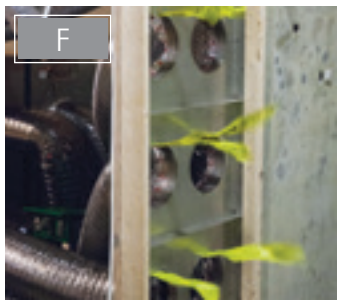
E On-site project management meeting.

F Negative air machine vents.

EPA's CMAD partnered with the DHS on the Underground Transport Restoration (UTR) Project, a 4-year effort involving multiple federal agencies, including the EPA, DHS, Lawrence Livermore National Laboratory (LLNL), Massachusetts Institute of Technology Lincoln Labs (MITLL), Argonne National Laboratory (ANL), Sandia National Laboratory (SNL), and Pacific Northwest National Laboratory (PNNL). The main focus of the UTR project was to develop guidance for the rapid return to service of a subway system contaminated with a biological agent, such as Bacillus anthracis (Ba). EPA was the lead on several aspects of the project and assisted the other federal agencies and national laboratories in their efforts. The UTR program improves the capacity of U.S. agencies to respond to and recover from a biological incident in a subway system. For additional information and technical reports on UTR projects, please contact Shannon Serre (serre.shannon@epa.gov). Examples of UTR project activities are provided throughout this section.

Bench-Scale Testing

EPA conducted bench-scale testing on methods that could potentially be used to inactivate *Bacillus* spores in a subway system. The testing including evaluation of sporicidal liquids for fumigation and assessing the efficacy of methyl bromide (MB) and chlorine dioxide on subway surfaces. Fumigation in a subterranean environment poses challenges related to containment of the fumigant as well as the control of the operational parameters of temperature and relative humidity (RH). Sporicidal conditions for fumigation typically require temperatures exceeding 70 °F and an RH exceeding 70%. In an underground system, with no air exchange, the surface and air temperature typically are at the ground temperature of 50 °F. The bench-scale tests were conducted at a temperature of 50 °F and an RH of less than 70%. As in other similar fumigant evaluation studies, the bench-scale testing found that temperature, RH, fumigant concentration, and time affect the efficacy of MB against *Ba*. Exposure to MB at 212 milligrams per liter (mg/L) for 4 days was required to achieve a log reduction of 6 or greater for the *Ba* surrogate on all materials at 50 °F and 75% RH.



G Decontamination efficacy assessment samples were collected after fogging.

H The bench-scale testing in the laboratory found that temperature, RH, fumigant concentration, and time affect the efficacy of MB against *Ba*.

Evaluation of Biological Agent Dispersion (Phenomenology Testing)

MITLL and ANL were tasked with examining the dispersion of a biological agent simulant in the New York City subway system. During this fate and transport test, EPA analyzed samples and provided personnel to collect the samples and manage data for the field sampling effort. Results showed that the simulant contaminated not only the subway system but also areas above and adjacent to the system. In the event of an intentional biological agent release, these outdoor areas would require remediation in addition to the subway system. EPA is pursuing a new program focused on the remediation of the outdoor environment after a biological agent release.

(*see inset story*)

Next Steps: EPA Research to Address UTR Gaps in Outdoor Environments Contaminated with *Bacillus anthracis*

Over the past several years, EPA, in partnership with the DHS Science and Technology Directorate (S&T) and other federal partners, states, and local governments, has been evaluating strategies and tactics for responding to an intentional release of *Ba*. Significant progress has been made in developing capabilities and preparedness to respond to indoor contamination incidents, especially for relatively contained incidents (such as single facilities). The interagency effort on Bioresponse Operational Testing and Evaluation (BOTE) highlighted current capabilities and provided a full-scale assessment of preparedness for single-facility incidents. The Interagency Biological Restoration Demonstration (IBRD) and subsequent Wide-area Recovery and Resiliency Program (WARRP) highlighted the state of preparedness for responding to a widespread contamination incident and significant gaps in mitigating the consequences and enabling recovery through environmental remediation.

The UTR project was implemented by DHS S&T to address gaps related to the rapid return to service of subway systems after contamination with a biological agent such as *Ba*. As part of the Phenomenology Testing effort (*see above*), MITTL and ANL demonstrated the potential widespread nature of the release of a persistent biological agent (such as *Ba*) and quantitatively confirmed that such a release would contaminate the aboveground outdoor metropolitan area. The UTR project, as a whole, focused on belowground remediation capabilities and did not address capabilities for the aboveground outdoor urban environment, but the project further highlighted the gap in response and remediation capabilities for the aboveground outdoor environment.

Wide-area remediation presents many challenges, including balancing the limited resources available with the need to characterize contamination, conduct decontamination, and manage waste materials. Capabilities and an operational strategy for cleaning up the outdoor environment do not exist for a biological agent incident and represent a major preparedness gap. Field-scale testing is a critical step in scaling up bench-scale research and transitioning the research results to the end-users, thus increasing the nation's capabilities and allowing preparation of proven response plans for wide-area release scenarios.

Some progress has been made in developing capabilities for remediation activities based on laboratory studies. However, additional capability development and outdoor field testing are critically needed to develop sound preparedness, guidance, and tactical information.

Moving forward, EPA has developed a 3-year, multi-agency project designed to investigate the current status of outdoor *Ba* decontamination research, improve the understanding of outdoor particulate movement and deposition to inform mitigation and remediation activities, and develop guidance and tactics to support wide-area response and remediation decisions.

A ER Trailer on site at UTR-OTD.

B EPA Region 3 Command trailer at UTR-OTD.

C CMAD staff preparing for sampling entry at UTR-OTD.

D Air-O-Fan® sprayer operating in the UTR-OTD tunnel.

E DustBoss® sprayer and Air-O-Fan® sprayer in the UTR-OTD tunnel.

F Level A team entering for tunnel decontamination.

UTR-Operational Technology Demonstration (OTD)

The UTR-OTD was a full-scale study focused on gathering sampling, decontamination, waste management, and cost analysis information for the remediation of a subway system after contamination with a *Ba* surrogate. The study venue was in EPA Region 3 at Fort A.P. Hill in Bowling Green, VA. The work involved all aspects of remediation of a subway system tunnel and platform (except for rolling stock, maintenance yards, and related facilities) contaminated with a *Ba* surrogate, including pre-decontamination and post-decontamination verification sampling and waste management.

The UTR-OTD project consisted of two separate rounds of decontamination of a mock subway system. Round 1 used fogging with dilute bleach, and Round 2 used a low-pressure commercial sprayer to spray pH-amended bleach (pAB). Both rounds included a decontamination efficacy assessment, composite sampling, a grimed and non-grimed coupon study, a waste management assessment, and an overall cost analysis of the decontamination approaches.

For Round 1, 132 decontamination efficacy assessment samples were collected after fogging. Approximately 8% of the sample results were positive for the *Ba* surrogate after decontamination. Excluding the subway kiosk area, only 4 out of 106 samples (4%) had positive results ranging from only 3 to 11 colony-forming units (CFU). For the kiosk materials, positive results ranged from 12 to 2,395 CFUs.

For Round 2, 137 decontamination efficacy assessment samples were collected after spraying. Approximately 4% of the sample results were positive for the *Ba* surrogate after decontamination. Excluding the kiosk area, only 1 out of 111 samples (1%) had a positive result of only 6 CFUs. For the kiosk materials, positive results ranged from 5 to 500 CFUs.

For both the fogging and spraying decontamination methods, most positive results were for samples collected from the subway kiosk area, which contained porous and organic items commonly found in subway convenience stores. The removal of these porous materials for *ex situ* waste treatment may be the most effective approach for ensuring that materials do not contain

residual spores. No adverse impacts on the facility or its components were observed for either decontamination method.

EPA also examined the feasibility of using commercially available equipment to spray a sporicidal liquid inside a subway tunnel. The study culminated with the demonstration of a DustBoss®system as well as an Air-O-Fan® orchard spraying unit at the OTD test site. Water was sprayed using the commercially available equipment to demonstrate the feasibility of this equipment to distribute a sporicidal liquid such as diluted bleach or pAB.

Evaluation of MB as a Fumigant

As part of an earlier field study during the UTR project, EPA conducted a scientific study to evaluate MB as a fumigant for decontaminating subway railcars contaminated with *Ba* using surrogate *Ba* Sterne strain spores. The study was designed to evaluate the operational aspects and efficacy of MB for inactivating the surrogate *Ba* spores on a mock subway railcar. The study goals were to gain large-scale information on the use of MB for decontaminating *Ba* spores and to develop site-specific plans and guidance that could be modified and used during a real-world incident. MB was selected as the study fumigant because it (1) has shown to be efficacious in inactivating *Ba* spores during laboratory testing, (2) is not corrosive like some of the oxidizing fumigants, and (3) can be captured on activated carbon to limit its release to the environment. Based on several positive *Ba* surrogate results for test coupons (primarily vinyl seat covering) from a 36-hour fumigation, the study recommends fumigating a railcar for *Ba* using MB at a concentration of 212 mg/L for 48 hours at 75 °F and a RH of 75%. In addition, based on eight positive results for the vinyl seat covering coupons, the study recommends that railcar seating material be sprayed down with pAB before fumigation to aid in the inactivation of *Ba* spores.

A DustBoss® sprayer in the UTR-OTD tunnel.

B UTR-OTD tunnel prior to release of surrogate.

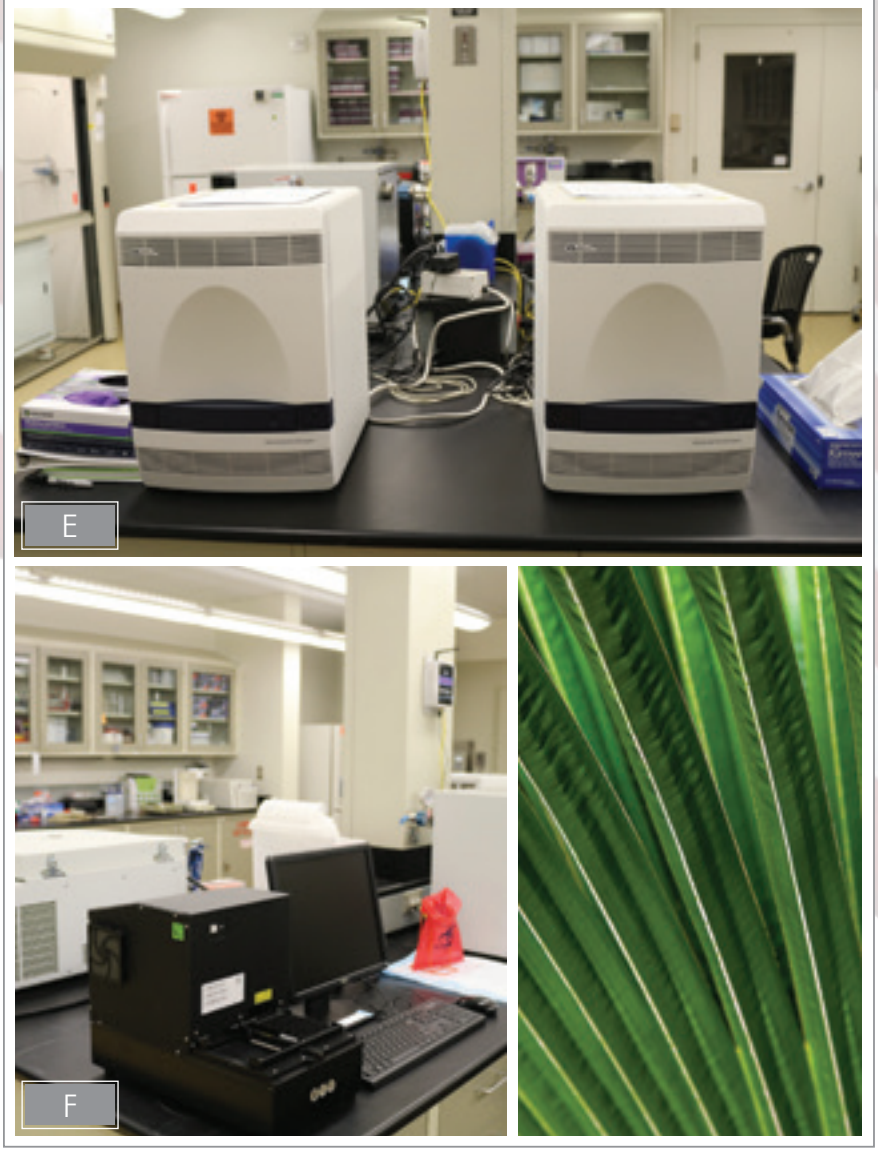
C Railcar wrapped during MB fumigation.

D Test solutions being prepared in the tunnel.

CMAD Bioanalytical Laboratory (CBL) Collaboration and Addition of Capabilities

After analyzing more than 600 samples for the UTR-OTD during a 6-week period in Fall 2016, the CBL continues to add capabilities and collaborate with partners to maintain a high level of readiness to serve EPA and federal response partners. CMAD continues to ensure mission readiness for the CBL. The laboratory has renewed its certification to maintain its Biosafety Level-2 Enhanced (BSL-2E) designation, allowing it to analyze clearance samples from a biological agent incident. CMAD is in the early stages of evaluating the CBL's ability and need to analyze characterization samples from a biological incident. EPA is working with the laboratory certification entity to evaluate the safety and regulatory implications of such an operation. CMAD will update the response community on any changes to CBL's operations and capabilities.

In addition, the CBL has been diligently training and acquiring materials required to add the Rapid Viability-Polymerase Chain Reaction (RV-PCR) capability to the laboratory. The RV-PCR method was developed through a joint effort between EPA's NHSRC and LLNL. RV-PCR drastically reduces the time and materials required to analyze biological samples and provides the advantages of culture-method analysis in determining the viability of a biological agent. The CBL's biologist attended a training event taught by one of the method's lead developers at LLNL and acquired the necessary equipment for conducting RV-PCR analysis at the CBL. The CBL will be working with the NHSRC to develop verification data to further test RV-PCR's utility for EPA's CBRN emergency response mission.



E

RV-PCR instruments.

F

Electrochemiluminescence (ECL) instrument for toxin immunoassay analysis.

ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-containing material
AHWO	After Hours Watch Officer
ANL	Argonne National Laboratory
ASPECT	Airborne Spectral Photometric Environmental Collection Technology
Ba	*Bacillus anthracis*
BOTE	Bioresponse Operational Testing and Evaluation
BSL	Biosafety Level
BSL-2E	Biosafety Level-2 Enhanced
CBL	CMAD BioAnalytical Laboratory
CBRN	Chemical, Biological, Radiological, and Nuclear
CFU	Colony-forming unit
CLP	Contract Laboratory Program
CMA	Chemical Material Agency
CMAD	Consequence Management Advisory Division
CST	Civil Support Team
CWA	Chemical warfare agent
CWAPG	Chemical Warfare Agent Preparedness Workroup
DHS	Department of Homeland Security
DoD	Department of Defense
EDD	Electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
ERLN	Environmental Response Laboratory Network
ERT	Environmental Response Team
EU	Environmental Unit
FTIR	Fourier Transform Infrared Spectrometer
FY	Fiscal year
GPS	Global positioning system
HAZMAT	Hazardous material
HD	Sulfur mustard
HVAC	Heating, ventilation, and air conditioning
IBRD	Interagency Biological Restoration Demonstration
IC	Incident Command
IR	Infrared
LLNL	Lawrence Livermore National Laboratory
MB	Methyl bromide
mg/L	Milligram per liter
MITLL	Massachusetts Institute of Technology Lincoln Labs
NBAF	National Bio and Agro-defense Facility
NELAP	National Environmental Laboratory Accreditation Program
NHSRC	National Homeland Security Research Center
NRPG	National Radiation Preparedness Group
ORD	Office of Research and Development
OSC	On-Scene Coordinator
OTD	Operational Technology Demonstration
pAB	pH-amended bleach
PCAD	Pueblo Chemical Army Depot
PHILIS	Portable High-Throughput Integrated Laboratory Identification System
PLDA	Piecewise linear discriminant analysis
PNLL	Pacific Northwest National Laboratory
RH	Relative humidity
RMP	Risk management plan
RRT	Regional Response Team
RTFL	Radiation Task Force Leader
RV-PCR	Rapid Viability-Polymerase Chain Reaction
S&T	Science and Technology
SME	Subject matter expert
SNL	Sandia National Laboratory
SOP	Standard operating procedure
SVOC	Semivolatile organic compound
TWG	Technical Working Group
USCG	U.S. Coast Guard
UTR	Underground Transport Restoration
VOC	Volatile organic compound
VSR	Versatile SpectroRadiometer
WARRP	Wide-area Recovery and Resiliency Program
WMD	Weapon of mass destruction

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VISION: Serve as EPA's national special team providing leadership, expertise, and response capabilities for Chemical, Biological, Radiological, and Nuclear (CBRN), as well as all-hazard events.

MISSION: CBRN Consequence Management Advisory Division's (CMAD's) mission is to prepare and support the emergency response community 24/7/365 during CBRN and all-hazard events. CMAD provides science-based solutions and response services during all phases of crisis and consequence management by deploying both personnel and assets.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Chemical, Biological, Radiological, and Nuclear
Consequence Management Advisory Division

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