CMAD’s PHILIS* Labs
Capabilities and Recent Activities

Region 2 RRT meeting, October 2016

TICs and CWAs - High Throughput Mobile Analysis

* Portable High-Throughput Integrated Identification System
PHILIS Labs Capabilities – All Hazards Response

- Road worthy within 6 hours of notification; Set up and running within 6 hours upon arrival on site
- Able to run 4 days before restocking/refueling required; operated via diesel generators or connection to shore power; arrives fully stocked (consumables, chemical standards, etc.) and can resupply via courier
- Automated sample prep equipment, able to process a minimum of 100 samples/day total for fully staff 24-hr work cycle; separate prep and analytical areas
- All mobile assets connected via wireless, encrypted LIMS
- Compatible with EPA’s Scribe, Promium LIMS (SEDD)
  - PHILIS data will be compatible with EPA’s WebEDR
- Mobile labs assets located in East Coast (Edison, NJ) and West Coast (Castle Rock, CO) warehouse locations with both fixed and mobile assets
Current PHILIS Laboratory Vehicles

- PAL - Analytical Laboratory
- APL01 & APL02 - Analytical Laboratories
- PHILIS LU - PHILIS Laboratory Unit
- SPA - Sample Preparation
PHILIS Support Vehicles

SSA - Sample Storage

SLA - Sample Log-In

SPA Storage – Sample Preparation and Storage

Tow Vehicle
PHILIS Labs Analytical Methods

SVOCs via 8270D – NELAP accredited, all matrices
- Includes PAH (18) subset method
- Low, med & high range methods, “Twister” rapid prep methods

VOCs via 8260C – NELAP accredited, all matrices
- Includes BTEX subset method
- Rapid head space VOC method
- Low, med & high range methods

PCBs via 8082A – NELAP accredited, all matrices (9 Aroclors)

Air toxics via TO17 (VOCs/BTEX) – pursuing NELAP certification
- Sorption tubes, Tedlar bags, SUMMA canisters

Carbamates via ASTM D7645-10, LC/MSMS fixed lab

Misc CWA breakdown products via LC/MSMS fixed lab
- Ethanolamines (4), Nitrogen Mustard breakdown products
- Organophosphates (7), Nerve agent breakdown products

Pesticides (Dicamba) via mobile & fixed LC/MSMS fixed labs

PFAS via fixed LC/MSMS (evolving)

Volatile Organics: GC/MS, GC/MS SIM, GC/MS TOF

Semivolatile Organics: GC/MS, GC/MS SIM, GC/MS TOF

PAH: GC/MS, GC/MS SIM

PCB: GC/MS, GC/MS SIM, GC/ECD

Carbamates: LCMS

Explosives: LCMS

CWA: GC/MS TOF, GC/MS, LCMS
<table>
<thead>
<tr>
<th>Contaminant of Concern</th>
<th>Method</th>
<th>Matrix</th>
<th>NELAP Accreditation</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVOCs</td>
<td>8270</td>
<td>All Matrices</td>
<td>Yes</td>
</tr>
<tr>
<td>PAH</td>
<td>8270</td>
<td>All Matrices</td>
<td>Yes</td>
</tr>
<tr>
<td>VOCs</td>
<td>8260</td>
<td>All Matrices</td>
<td>Yes</td>
</tr>
<tr>
<td>VOCs Headspace</td>
<td></td>
<td>All Matrices</td>
<td>Screening Method</td>
</tr>
<tr>
<td>VOCs</td>
<td>524.2</td>
<td>Drinking Water</td>
<td>Yes</td>
</tr>
<tr>
<td>SVOCs</td>
<td>525.2</td>
<td>Drinking Water</td>
<td>In process</td>
</tr>
<tr>
<td>PCBs</td>
<td>8082A</td>
<td>All Matrices</td>
<td>Yes</td>
</tr>
<tr>
<td>Herbicides by LC/MS/MS</td>
<td>8321</td>
<td>All Matrices</td>
<td>Yes</td>
</tr>
<tr>
<td>Dicamba by LC/MS/MS</td>
<td>8321</td>
<td>All Matrices</td>
<td>TBD</td>
</tr>
<tr>
<td>Organophosphorus Pesticides</td>
<td>8270</td>
<td>All Matrices</td>
<td>Yes</td>
</tr>
<tr>
<td>Air Toxics by Sorbent tube, Tedlar bag, Summa Can</td>
<td>TO-17</td>
<td>Air In process</td>
<td>TBD</td>
</tr>
<tr>
<td>Carbamates and Pharmaceuticals</td>
<td>ASTM D7645-10</td>
<td>water</td>
<td>TBD</td>
</tr>
<tr>
<td>CWA breakdown products - Ethanolamines</td>
<td>LC/MS/MS</td>
<td>All Matrices</td>
<td>TBD</td>
</tr>
<tr>
<td>CWA breakdown products - Organophosphates</td>
<td>LC/MS/MS</td>
<td>All Matrices</td>
<td>TBD</td>
</tr>
<tr>
<td>Explosives</td>
<td>LC/MS/MS</td>
<td>All Matrices</td>
<td>TBD</td>
</tr>
</tbody>
</table>
PHILIS Labs – Chemical Warfare Agent Response
Primary Mission

- PHILIS labs are part of the EPA’s Emergency Response Laboratory Network (ERLN) – building the EPA’s capability and capacity to respond to CWA and All-Hazard incidents
  - ERLN provides uniform methods, QA/QC criteria, PT samples and UDA standards to participating labs
  - Regions 1, 3, 6, 9 and 10; and the LRN labs (chem) at the states of VA & FL
  - PHILIS labs are the only mobile assets within the ERLN
- EPA receives Ultra-dilute Agent standards from DoD reference lab(s)
  - G-agents, sulfur mustard and VX at low concentrations – how low, the UDA standards are shipped to the ERLN labs via FedEx!!
- PHILIS currently has UDA standards at Castle Rock, CO location
  - Pursuing CWA capabilities for NJ PHILIS assets – more to follow
- Need to expand beyond our core mission of CWAs – All Hazard Response
### PHILIS Labs Capabilities
**MDLs for Chemical Agents - Just in Case You Asked**

<table>
<thead>
<tr>
<th>Compound</th>
<th>CAS No.</th>
<th>Water (ug/L)</th>
<th>Water (ug/L)</th>
<th>Soil (ug/kg)</th>
<th>Soil (ug/kg)</th>
<th>Air Screening (pg)</th>
<th>Soil (ug/Kg)</th>
<th>Wipe (ng/Wipe)</th>
<th>Wipe (ng/Wipe)</th>
<th>Wipe (ng/Wipe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarin (GB)</td>
<td>107-44-8</td>
<td>0.28</td>
<td>0.6</td>
<td>0.61</td>
<td>0.46</td>
<td>1.52</td>
<td>2.8</td>
<td>2</td>
<td>3.9</td>
<td>45</td>
</tr>
<tr>
<td>Soman Total</td>
<td>96-64-0</td>
<td>0.087</td>
<td>0.3</td>
<td>1.2</td>
<td>0.62</td>
<td>1.53</td>
<td>3.1</td>
<td>4.0</td>
<td>5.4</td>
<td>170</td>
</tr>
<tr>
<td>Mustard (HD)</td>
<td>505-60-2</td>
<td>0.18</td>
<td>0.44</td>
<td>0.24</td>
<td>0.22</td>
<td>0.54</td>
<td>4.2</td>
<td>1.5</td>
<td>1.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Cyclosarin (GF)</td>
<td>329-99-7</td>
<td>0.25</td>
<td>0.18</td>
<td>1.4</td>
<td>0.43</td>
<td>1.77</td>
<td>2.4</td>
<td>2.5</td>
<td>5.4</td>
<td>160</td>
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<tr>
<td>VX</td>
<td>50782-69-9</td>
<td>0.36</td>
<td>1.3</td>
<td>NR</td>
<td>0.41</td>
<td>0.97</td>
<td>NR</td>
<td>5.0</td>
<td>3.2</td>
<td>NR</td>
</tr>
</tbody>
</table>
PHILIS’ Data Packages

• Promium based LIMS
  • Connected via encrypted wireless modem
  • Remote access, data sharing via FTP site

• Electronic Data Deliverables - Flexibility
  • Daily Prelims via Excel Spreadsheets
  • Tier 1, 2 & 3 EDD

• Scribe compatible – this is now a big deal!
  • Recent OLEM directive to use SCRIBE at all large national responses – what does that really mean?

• Web based Data Validation (WebEDR)
  • Share lab data amongst the ICLN labs

• Can Generate a “CLP-like” Data Package
  • Some Regions Analytical Services Reps may only accept data in the CLP format
PHILIS Site Work For the Regions
Region 2 RACER Trust Site

- Region 2 RPM requested use of CMAD’s mobile assets to provide 24-hr turn-around analysis of soils for PCBs to expedite residential excavation activities – several residents were evacuated during digging activities
- Joint effort of CMAD, Region 2, RACER Trust Fund, NYS DEC & DOH
- PHILIS lab assets from NJ deployed to RACER site in Salina, NY for 6-8 weeks, deployment started September 6th, 2016
  - APL02 mobile lab w/2 ECD/GC systems, and SPA01 sample prep trailer
  - NELAP certified method 8082A, for 9 Arochlors
  - > 500 samples so far – PHILIS in-warehouse support after mobilization??
- PHILIS providing prelims within 24Hrs, QA’ed data with 48Hrs and a CLP B data package format with 2 weeks after submission
- Expanding beyond the CWA mandate – Dual Use/All-Hazard Response
Region 1 Jones & Lamson PCB Site
PHILIS In-warehouse Support

- Region 1 OSC requested rapid turn-around analysis of soils for PCBs
  - Used NJ based APL02 lab w/dual ECD/GC system, and SPA01 sample prep trailer
  - NELAP certified method 8082A, for 9 Aroclors
- Region 1 labs were unable to run samples at the time
- To keep CMAD and Region 2 costs down, samples were shipped by Region 1 STARTS overnight via FedEx to Edison, NJ warehouse for rapid turn-around prep and analysis
- PHILIS provided OSC w/prelims within 24Hrs upon receipt
  - Daily Scribe deliverable EDDs generated and sent to OSC and STARTs
- Expanding PHILIS capabilities beyond the CWA mandate
  - Dual Use/All-Hazard responses
Region 7, NEIC Support
Dicamba Pesticide Response

- Unlicensed use of dicamba herbicide on > 400 agricultural fields, > 40,000 total acreage, across several states
- Initial estimate of >1,200 samples, soils, vegetation, crops
- Multi-agency effort: CMAD, Region 7, NEIC, Purdue, U of I, U of Mo., State Ag, OPP, other labs from state, federal and academia
- PHILIS LC/MSMS system out of Castle Rock, CO
- Deploy PHILIS assets to NEIC at Denver Federal Center: PAL mobile lab and SPA prep trailer – methods development and sample analysis
- Analysis of dicamba and numerous selected metabolites (evolving)
- Expanding beyond the CWA mandate – Dual Use/All-Hazard Response
Region 5 - Flint Water Crisis Response

- Direct request from R5 for CMAD support to the Region 5 Flint water crisis
  - R5 support at ARGO in Nov-Dec 2015 paid off!!
- CMAD providing both in-house and subcontract analytical support through the PHILIS contract and reach back lab mechanism
- Subcontract support for metal analysis, PHILIS reach back to TA
  - So should PHILIS pursue metals capabilities – 3rd or 4th request for this??
- PHILIS obtained NELAP certification on several water methods to run Flint samples: TTHM, Halo-AA and Nitriles – see summary table
  - > 3000 samples run thus far, still running (5th “last batch” at RACER site)
- Expanding beyond the CWA mandate – Dual Use/All-Hazard Response
<table>
<thead>
<tr>
<th>Description/ lab</th>
<th>Matrix</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performed at TA Canton Lab</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Metals List</td>
<td>Drinking Water</td>
<td>200.8</td>
</tr>
<tr>
<td>24 Metals List</td>
<td>Drinking Water</td>
<td>200.8</td>
</tr>
<tr>
<td>13 Metals List</td>
<td>Particulates from faucet aerator</td>
<td>6020</td>
</tr>
<tr>
<td>Turbidity</td>
<td>Drinking Water</td>
<td>180.1</td>
</tr>
<tr>
<td>Alkalinity</td>
<td>Drinking Water</td>
<td>2320B - 1997</td>
</tr>
<tr>
<td>Anions</td>
<td>Drinking Water</td>
<td>300.0</td>
</tr>
<tr>
<td>Total Dissolved Solids</td>
<td>Drinking Water</td>
<td>SM 2540C</td>
</tr>
<tr>
<td><strong>Performed at PHLIS Edison Operations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trihalomethanes</td>
<td>Drinking Water</td>
<td>524.2</td>
</tr>
<tr>
<td>Haloacetic acids</td>
<td>Drinking Water</td>
<td>552.3</td>
</tr>
<tr>
<td>Haloacetonitriles, Chloral Hydrate, Chloropicrin</td>
<td>Drinking Water</td>
<td>551.1</td>
</tr>
<tr>
<td>Semivolatiles</td>
<td>Drinking Water</td>
<td>525.2 (mod)</td>
</tr>
</tbody>
</table>
An abandoned “deterrent” safe found during building renovations, may have been booby-trapped with sulfur mustard or other toxic chemical materials.

- 1920-40’s safes were often booby trapped with toxic chemicals to discourage thieves.

Region 7 requested rapid analysis of wipe samples from safe and room and intact vials for chemical agents and/or related materials.

- Referral via R7 OSC, who is a member of the CWA Prep WG lead by CMAD.

- Exact nature of samples unknown – real life exercise for the “big one.”

- Provided sampling “kits” to local Haz-mat sample teams to collect samples for PHILIS lab.

- Same day analysis was obtained via PHILIS CWA certified lab in CO.

- No CWAs or related toxic compounds – safe released to building owner.

- Screened/searched for phosgene via NIST library search of TICs.
Region 5 Support at RNC – Psycho Stickers

- Region 5 requested on-site analytical support during the RNC - NSSE
- CMAD deployed PHILIS assets from both CO & NJ warehouses
- PHILIS set up for CWA analysis as well as VOCs & SVOCs for all matrices
  - UDA CWA standards on site w/PHILIS, opportunity for PHILIS lab cross-training
- CMAD provided “just in time” training for OSCs in CWA sampling and response
- During RNC public demonstrations an individual placed “stickers” on several people including LLEOs who felt a tingling, burning sensation upon removal
- PHILIS run several stickers and wipes for G-agents, HD and VX, associated breakdown products and ran a spectral library search for controlled substances
- No CWAs or related toxic compounds found on stickers (worried well?)
  - Only lab asset at the RNC that was operational for CWA analysis
• PFOA/PFOS and other PFAS related compounds contamination from the wide spread use and manufacture of Teflon related products, fire retardant chemicals, etc. PFC contaminated groundwater, surface water, residential wells and drinking water utilities across the nation, epicenter is the NE

• Evolving, politically charged water contamination crisis

• PFOA/PFOS removed from many manufacturing processes by decree but PFASs not really regulated and ubiquitous – you have some on you now!

• Analytical methods are difficult, equipment expensive and action levels already very low and getting even lower (400 → 70 → 14 → 2 → ?) ng/L (part per trillion)

• Joint EPA WG on PFAS method development (OSRTI/OEM/Regions/OW/ORD)
  • No Validated method exists for PFAS other than Drinking Water Method 537
  • PHILIS' fixed LC/MSMS system in NJ working on methods w/ WG
Future Work w/DoD to Expand PHILIS’ UDA Capabilities

• PHILIS in planning with DoD/CMA in CO to provide air analysis during demil activities at the PCAD facility – starting in 2017
  • Sharing PHILIS/DoD SOPs and QMP w/ labs in both PCAD, CO and ECBC at the APG in MD
• PHILIS is planning visit to the ECBC facility at APG, MD, along with CBARR, to run our UDA CWA standards using the NJ PHILIS assets and staff to achieve CWA accreditation for NJ PHILIS assets – Fall/Winter 2016
  • Stopgap measure until we get permission to use UDA standards at EPA’s facility at Edison, NJ
  • Possible joint lab exercise
• OEM/CMAD IAG w/ECBC for CWA support – Partnership with ERT
  • Leveraged buy into the current ERT IAG w/ECBC for specific CMAD directed tasks
  • Second source for UDA standards
  • Training, exercises, technical support
  • Continued work with the CBARR group at ECBC/APG
Access to Analytical Capability
PHILIS Mobile Lab

Access PHILIS Directly by contacting POCs:

**POCs**
- Paul Kudarauskas/CMAD/ FOB Branch Chief: (o) 202-654-2415, (cell) 202-344-5382, Kudarauskas.Paul@epa.gov
- Terry Smith/ OEM: (o) 202-564-2908, (cell) 202-503-8981, Smith.Terry@epa.gov
- Larry Kaelin/ CMAD/FOB: (o) 732-321-6625, (cell) 513-675-4751, Kaelin.Lawrence@epa.gov
- EOC Hotline: 202-564-3850
US EPA – Special Team for CBRN
CBRN Consequence Management Advisory Division (CMAD)

**Mission:** provides scientific and technical expertise for all phases of CBRN consequence management and is available to support the On-Scene Coordinators (OSC) 24/7

**Focus:** Operational preparedness for CBRN agents. Maintain ASPECT and PHILIS

**Support:** All phases of CBRN response, including characterization, decontamination, clearance and waste management

*Buildings, infrastructure, indoor and outdoor environments, transportation sectors*
Key Elements of Mission

• Bring the latest science and technology to the response community (primarily the EPA OSC), constantly promoting more efficient and effective CM through knowledge, tools, technology, playbooks/SOPs, policy, and guidance

• Identify gaps in CBRN remediation and develop/implement innovative solutions, strategies and tactics

• Develop and maintain approaches and options for how to implement CBRN remediation that can be quickly tailored to an individual site/incident; Provide national consistency in CBRN consequence management planning and operations

• Participate in the development of policy to ensure consistency with current or evolving technical approaches to CBRN response options.
Building Anthrax Lab Capacity

**Biological Capabilities**

- 2 Bio-safety Level 3 facilities owned and operated by EPA
- OEM has developed partnership with OCSP, NEIC, and NHRSC to integrate anthrax analysis into labs daily operations
- Equip and train the labs to analyze anthrax samples in order to increase capacity utilizing the RV-PCR technique
Biological Detection Methods

Site Characterization Phase - Determine Extent of Contamination
- Sample processing methods (bioagent recovery and extraction of analyte)
- Analytical methods
  - Real-time PCR, immunoassay, GC-MS or LC-MS methods for biothreat agents

Post-Decontamination/Clearance Phase
- Sample processing methods (viable bioagent recovery)
- Analytical methods
  - Culture/Plating followed by real-time PCR or immunoassay
  - Rapid Viability PCR
Radiation Task Force Leader Training

- 10-day radiation safety course for EPA Response Support Corps personnel who will augment the existing Emergency Response Program personnel in a response to a major radiological contamination incident.
- 50 trained to date
- Funding comes from OEM and Regions
- Refresher Training Hammer Facility Richland, Washington (Using Tc-99m sprayed in training areas).
- Two week boot camp course in Erlanger, KY for new RTFL recruits.
- Considering development of a Bio and Chem TFL program
Airborne Spectral Photometric Environmental Collection Technology (ASPECT)

-Remote-Sensing & Imagery-
Chemical, Radiological & Situational Awareness
ASPECT - Operational Concept

- Provide a readiness level on a 24/7 basis
- Provide a simple, one phone call activation of the aircraft
- **Wheels up in under 1 hour** from the time of activation
- Once onsite and data is collected it takes about....

**~ 5 minutes to process and turn around data to first responders**

**Deployment Simplified:**
- Once on-scene collect chemical, radiological, or situational data (imagery) using established collection procedures
- Process all data within the aircraft using tested automated algorithms
- Extract the near real time data from the aircraft using a broadband satellite system and rapidly QA/QC the data by a dedicated scientific reach back team
- Provide the qualified data to the first responder enabling them to make informed decisions in minimal time
ASPECT -CURRENT SYSTEMS

ASPECT Uses Six Primary Sensors/Systems:

- An Infrared Line Scanner to image the plume
- A High Speed Infrared Spectrometer to identify and quantify the composition of the plume
- Gamma-Ray Spectrometer Packs for Radiological Detection NaI and LaBr and Boron Trifluoride (BF3) straw detectors
- High Resolution Digital Aerial Cameras with ability to rectify for inclusion into GIS
- Broadband Satellite Data System (SatCom)
Near Shore Oil Detection
Unsupervised Classification Infrared Image

Survey area ≈ 700m x 2100m

- RED (surface oil)
- GREEN (mixed oil/water)
- BLUE/CYAN (water/land/other)

Heavy Sheen
Thick Oil

Skimming Vessel

Oil on Water Product
Aerial Photography

❖ 12.5 MP High Resolution Digital Camera
❖ Automated Geo-Rectification/GIS Coded Images
❖ Full Ortho-Rectification (Camera Model) Correction
❖ Ability to Process in the Air-Approx. 3 Minute Turn-Around
❖ Compressed Transmission of Data Via SatCom
❖ Fast Turn Around on Images – Approx. 700 processed images per Hour
❖ All Products can be imported into:
   • Google Earth,
   • ESRI
   • Generic Geospatial software packages
   • Whatever the customers require
ENVIRONMENTAL RESPONSE LABORATORY NETWORK (ERLN)
An all hazards/all environmental media laboratory network for chemical (including CWA), biological and radiological Agents supporting the needs of the response community.

Allow for day-to-day use supporting incidents of any scale during preparedness, response, remediation.

Coordinated Partnership with National Homeland Security Research Center (NHSRC) and Office of Resource Conservation and Recovery (ORCR) for methods and method development.

Partnership with Office of Water’s Water Laboratory Alliance (WLA) and ORIA Radiological Laboratory program.
ERLN Current
143 Laboratories