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)
  - ü 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

PHILIS LU –
PHILIS Laboratory Unit

APL01 & APL02 –
Analytical Laboratories

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
  - ü Includes PAH (18) subset method
  - ü Low, med & high range methods, "Twister" rapid prep methods
- § VOCs via 8260C – NELAP accredited, all matrices
  - ü Includes BTEX subset method
  - ü Rapid head space VOC method
  - ü Low, med & high range methods
- § PCBs via 8082A – NELAP accredited, all matrices (9 Aroclors)
- § Air toxics via TO17 (VOCs/BTEX) – pursuing NELAP certification
  - ü Sorption tubes, Tedlar bags, SUMMA canisters
- § Carbamates via ASTM D7645-10, LC/MSMS fixed lab
- § Misc CWA breakdown products via LC/MSMS fixed lab
  - ü Ethanolamines (4), Nitrogen Mustard breakdown products
  - ü Organophosphates (7), Nerve agent breakdown products
- § Pesticides (Dicambia) 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
CWAs	GC/MS TOF, GC/MS, LCMS

PHILIS Laboratory Methods Cont'd

Contaminant of Concern	Method	Matrix	NELAP Accreditation
SVOCs	8270	All Matrices	Yes
PAH	8270	All Matrices	Yes
VOCs	8260	All Matrices	Yes
VOCs	Headspace	All Matrices	Screening Method
VOCs	524.2	Drinking Water	Yes
SVOCs	525.2	Drinking Water	In process
PCBs	8082A	All Matrices	Yes
Herbicides by LC/MS/MS	8321	All Matrices	Yes
Dicamba by LC/MS/MS	8321	All Matrices	TBD
Organophosphorus Pesticides	8270	All Matrices	Yes
Air Toxics by Sorbent tube, Tedlar bag, Summa Can	TO-17	Air	In process
Carbamates and Pharmaceuticals	ASTM D7645-10	water	TBD
CWA breakdown products - Ethanolamines	LC/MS/MS	All Matrices	TBD
CWA breakdown products - Organophophates	LC/MS/MS	All Matrices	TBD
Explosives	LC/MS/MS	All Matrices	TBD

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

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

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 Arochlors
- 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
Dicambia Pesticide Response

- Unlicensed use of dicambia herbicide on > 400 agricultural fields, > 40,000 total acreage, across several states
- Initial estimate of >1,200 samples, : soils, vegetation, crops
- Mutli-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 dicambia 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

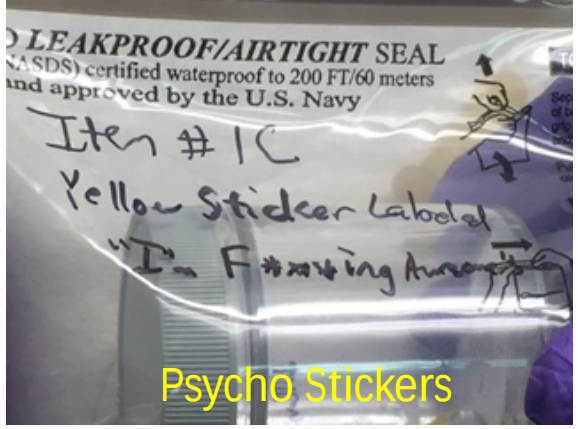
R 5 Flint Support Cont'd – Methods via Reach-back Contract & PHILIS - NJ

Description/ lab	Matrix	Method
Performed at TA Canton Lab		
13 Metals List	Drinking Water	200.8
24 Metals List	Drinking Water	200.8
13 Metals List	Particulates from faucet aerator	6020
Turbidity	Drinking Water	180.1
Alkalinity	Drinking Water	2320B - 1997
Anions	Drinking Water	300.0
Total Dissolved Solids	Drinking Water	SM 2540C
Performed at PHLIS Edison Operations		
Trihalomethanes	Drinking Water	524.2
Haloacetic acids	Drinking Water	552.3
Haloacetonitriles, Chloral Hydrate, Chloropicrin	Drinking Water	551.1
Semivolatiles	Drinking Water	525.2 (mod)

Region 7 - Abandoned “Deterrent Safe”

Glass ampule w/deterrent chemicals

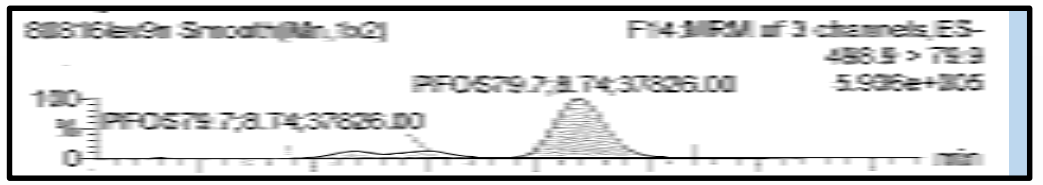
- An abandoned “deterrent” safe found during building renovations, may have been booby-trapped with sulfur mustard or other toxic chemical materials
  - 1920-40’s safes were often booby trapped with toxic chemicals to discourage thieves
- Region 7 requested rapid analysis of wipe samples from safe and 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

HQ Support - Drinking Water (PFAS)
Poly and per-fluorinated Alkyl Substances



- 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


Munitions “igloo”

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

EXTRA SLIDES

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 OCSPP, 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

26

Airborne Spectral Photometric Environmental Collection Technology (ASPECT)

-Remote-Sensing & Imagery-

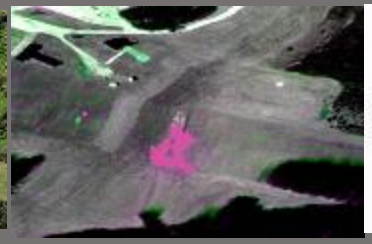
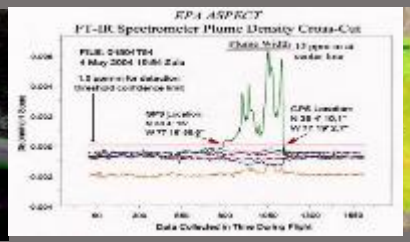
Chemical, Radiological & Situational Awareness

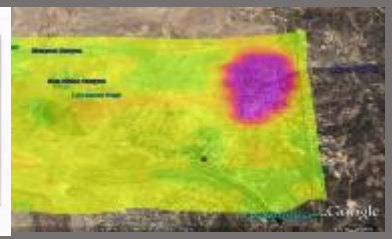
ASPECT - Operational Concept

- 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

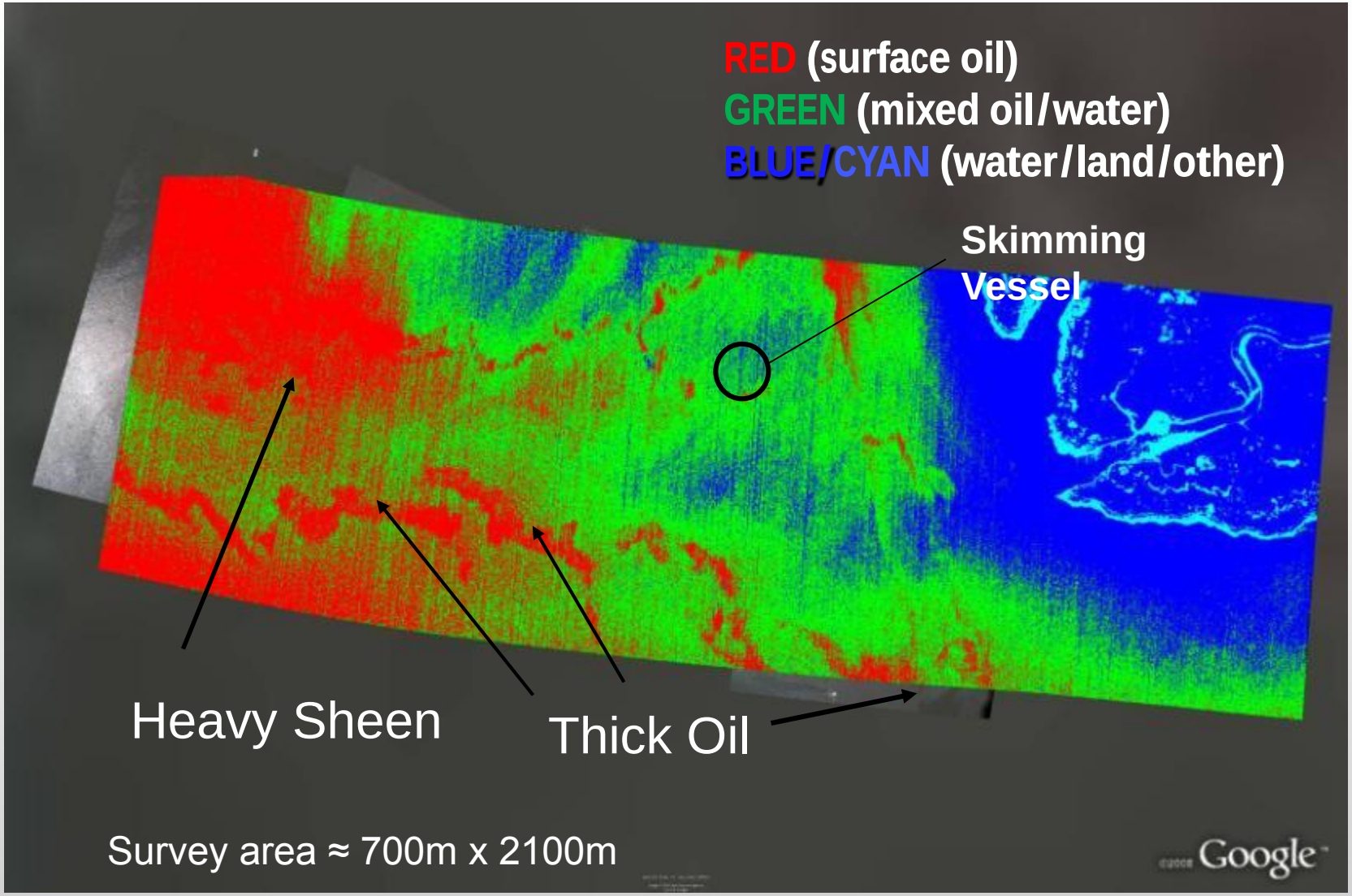
ASPECT -CURRENT SYSTEMS

ASPECT Uses Six Primary Sensors/Systems:

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

Near Shore Oil Detection

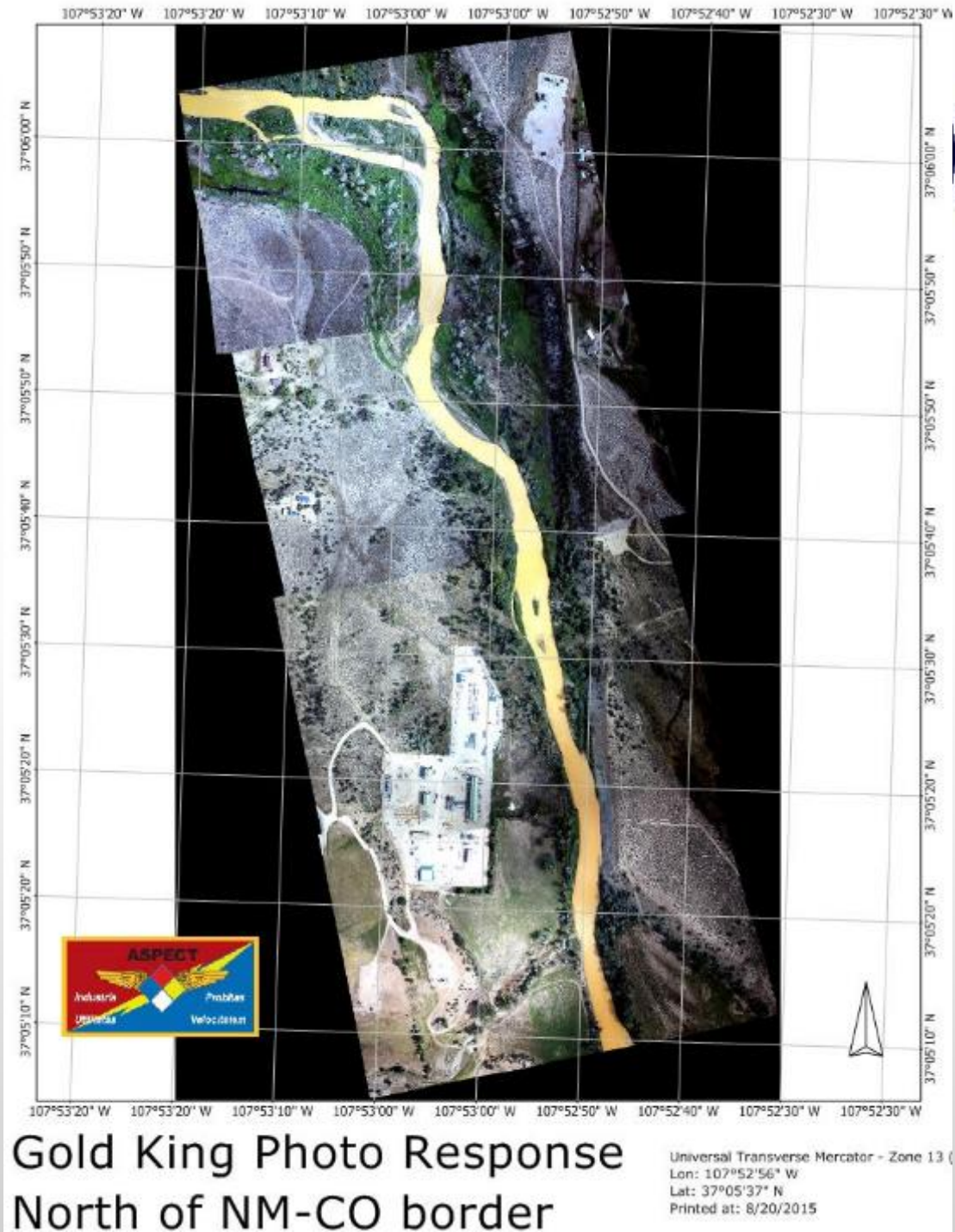
Unsupervised Classification Infrared Image



Oil on Water Product

Aerial Photography

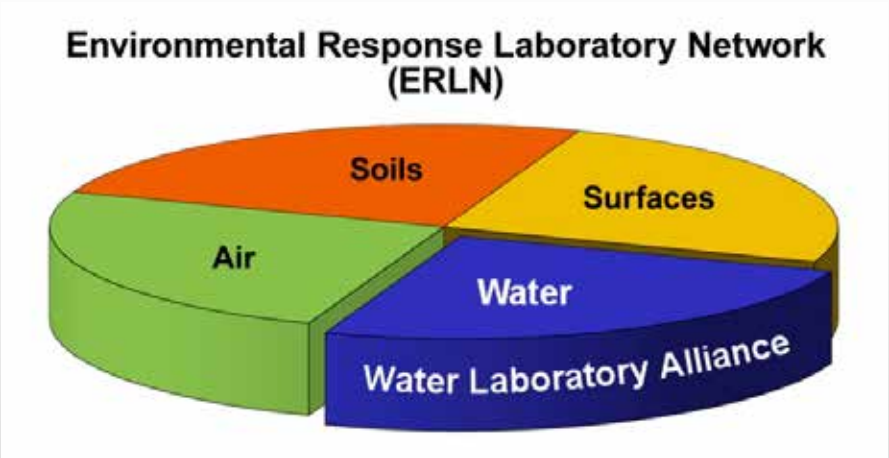
- 12.5 MP High Resolution Digital Camera
- Automated Geo-Rectification/GIS Coded Images
- Full Ortho-Rectification (Camera Model) Correction
- Ability to Process in the Air-Approx. 3 Minute Turn-Around
- Compressed Transmission of Data Via SatCom
- Fast Turn Around on Images – Approx. 700 processed images per Hour
- All Products can be imported into:
  - Google Earth,
  - ESRI
  - Generic Geospatial software packages
  - *Whatever the customers require*



ENVIRONMENTAL RESPONSE LABORATORY NETWORK (ERLN)

ERLN

Environmental Response Laboratory Network



- 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