

Outdoor Air
Quality



Environmental
Health
Laboratory

All Hazards Risk Assessment Laboratory (AHRAL) Past, Present, and Future

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Outdoor Air Quality Research Group Environmental Health Laboratory CDPH Richmond Campus

- Outdoor Air Quality - innovative laboratory methods research to elucidate sources of human exposure to airborne toxicants in the outdoor environment.
- Chemical Agents Identification - development of protocols and standard instrument operating procedures to characterize a potential chemical threat agent.
- Environmental Forensics – sampling through analysis solutions for identifying and characterizing the nature of direct human exposure
- Emergency Preparedness Unit – web-based training and exercises for hospital emergency response to mass causality CBRNE event
- Reach-back Laboratory CBRNE subject matter experts to support hospital emergency department threat recognition and response decision making





All Hazards Risk Assessment Laboratory (AHRAL) Trailer Isolation Screening Facility (post 911 infrastructure)

- Large Semi-Trailer manufactured by ENG Mobile Systems
- Located away from the main laboratory buildings at the facility loading dock
- This large capacity, special purpose, BSL3-ready lab is 53 ft. in overall length.
- Three compartments, separated by sealed bulkheads and doors





AHRAL Trailer Isolation Screening Facility Interior

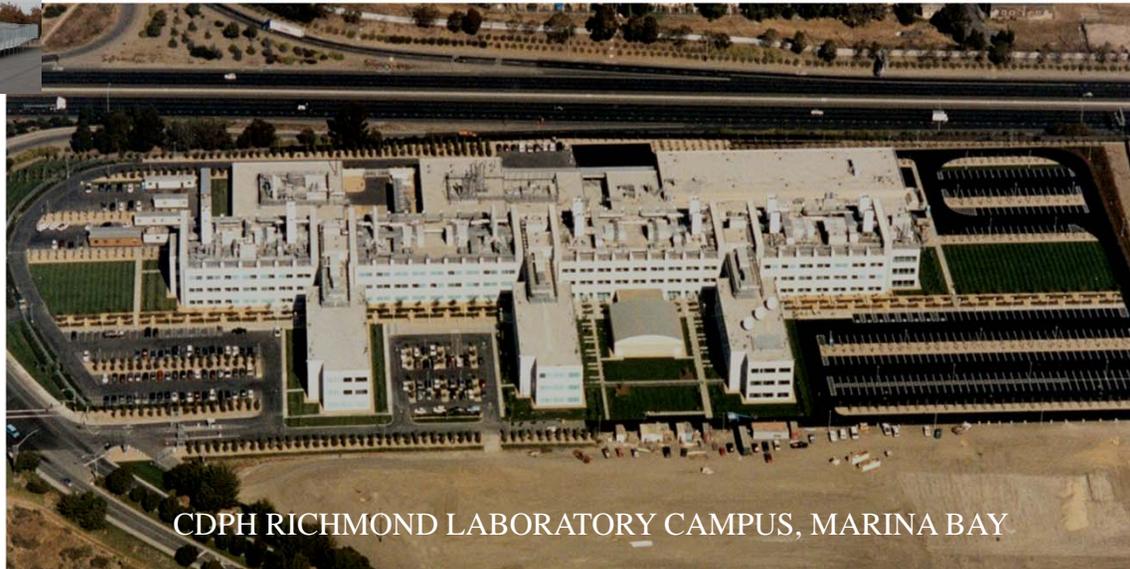
- LAMS III™ HEPA-filtered, heated air supply system with differential negative pressure in each of three compartments.
- DECON III™ stainless steel modular furniture system and sealed Marlite walls for effective decontamination
- Sample containment system includes serial Class III stainless steel glove box train with air locks and HEPA/carbon filtration
- End of the glove box train autoclave for threat agent decontamination
- Video security system, 40.0 kW diesel generator, five roof-mounted HVACs, sink and water system, safety shower, solvent cabinet, lab refrigerator, lab freezer and full electrical system.





AHRAL Original Design, Purpose, and Past Constraints

- CDPH Laboratories BSL-3 receipt facility for unknown threat level samples
- Isolated from and down-wind of CDPH mutli-laboratory program facility
- Available for subsampling and distribution to 2 clinical and 3 environmental labs
- Configured for staged sample screening in contained environment
- Requires development of standard well-accepted protocol for receiving, screening, documenting, and disposing of potential threat samples
- Need acquisition of proven test kits, handheld instruments, and supplies required by documented standard operating procedure



CDPH RICHMOND LABORATORY CAMPUS, MARINA BAY



All Hazards Receipt Facility (AHRF) Protocol

- Detailed flow scheme for receipt and screening of samples for known threats
- Chemical, Radiological, Nuclear, and Explosive (CRNE) threat detection
- Screening of receipt packages, sample containers, and samples
- No direct known biological threat organism screen

87 pages

DHS/S&T-PUB-08-0001
EPA/600/R-08/105



All Hazards Receipt Facility Screening Protocol

September 2008



84 pages



EPA/600/R-10/155 December 2010

Supplement to All Hazards Receipt Facility (AHRF) Screening Protocol



SCIENCE

Office of Research and Development
National Homeland Security Research Center

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Current Development and Implementation of CDPH AHRAL as US EPA Region 9 All Hazards Receipt Facility (AHRF)

- Develop the capability at their existing All Hazards Risk Assessment Laboratory (AHRAL) facility to screen unknown credible threat samples for subsequent analysis at EPA Region 9 Laboratory
- Sample screening shall be consistent with the methods identified in the All Hazards Receipt Facility Screening Protocol (DHS/S&T-PUB-08-0001 or EPA/600/R-08/105, September 2008) and “Supplement to All Hazards Receipt Facility Screening Protocol (EPA/600/R- 10/155 December 2010).
- Samples to be screened shall be delivered to the RLC AHRAL facility by US EPA or their agent following notification of the AHRAL staff and campus security to allow access during normal working hours.
- At the conclusion of screening, US EPA or their agent will be notified to retrieve the remaining sample material for subsequent analysis and disposal.
- Appropriate containers for sample submission, along with associated sample analysis and chain of custody forms will be developed by mutual agreement.





US EPA Region 9 All Hazards Receipt Facility (AHRF) CDPH Project

ACTIVITIES SUMMARY (October 2011 – April 2012)

High-Level Task	Milestones/Decision Point
A. Detailed final work plan	In consultation with US EPA Region 9, agree on SOW progress milestones
B. Identify AHRF capability gaps based on Screening Protocol	Detailed review of the "All Hazards Receipt Facility Screening Protocol", and the new "Supplement to All Hazards Receipt Facility"
C. Develop a draft SOP to identify sample acceptance criteria, test screening protocol	Specific screening procedures to be performed in each of the sequential fully contained glove boxes
D. Acquire screening resources to close capability gaps	Purchase test kits and screening instruments; Account for delivery time
E. Establish screening protocol as electronically tracked workflow	Environmental workflow procedure in laboratory information management system (LIMS)
F. Validate screening protocol SOP	Qualify performance of SOP resources by processing of test samples
G. Modify, Improve, and Finalize the SOP; Conduct screening test exercises for training of EHLB staff.	Based on test samples, modify staging of screening procedure for efficient use of ARHAL containment facilities.
H. Acquire any additional screening resources within the project guidelines.	Additional supplies and accessories to improve sample screening speed and capacity.
I. Conduct final test sample AHRAL screening to Validate the SOP	<i>Consultation with US EPA</i>
J. Inspection of the final screening facility	<i>US EPA site visit</i>
K. EHLB AHRAL staff will perform the AHRF standard operating procedures as a test exercise on a blank sample	<i>Demonstrate to US EPA the procedures developed for screening unknown or potentially hazardous samples.</i>
L. Prepare draft final report	<i>US EPA review and comments</i>
M. Submit final report with required changes.	<i>US EPA Approval</i>



AHRF Threat Class Specific Screening Equipment



Threat Category	Detection Technology/Type	Screening Equipment	Delivery Status	Threat Agent Simulants
Radiochemistry Detection Equipment				
Gamma/alpha/beta	Gamma/alpha/beta	Radalert100	Received	
Gamma	Gamma	BNC 935	Received	
Alpha/Beta	Alpha/Beta	Ludlum Model 2360	Received	
Colorimetric Testing Equipment				
Mustard	Colorimetric indicator reagent	DB-3 dye test	Received	CEES, H2O2
CWA, Organic	Colorimetric indicator paper	Hazsmart M8 papers	Received	DMMP, Dimethoate, CEES
Oxidizers	Colorimetric indicator paper	Starch iodide paper	Received	H2O2
pH	Colorimetric indicator paper	pH (Litmus) paper	Received	AsCl3
Explosives	Colorimetric indicator paper	DropEx Plus	Received	
Ion Mobility Spectrometry (IMS)				
CWA, TIC	IMS	Smiths Detection LCD 3.3E IMS	Received	Dimethoate, DMMP, CEES
CWA, TIC, Explosives	IMS	Smiths Detection Sabre 5000	Received	
Enzyme / Immunoassay Detection Equipment				
NO3	Enzyme Polymer Technology (ELITE™)	ELITE™ Card	Received	
CWA, Blood, Choke	Enzyme Polymer Technology	Anachemia M256A1 kit	Received	AsCl3, CEES, DMMP, Dimethoate
Flame Spectrophotometry (FSP)				
CWA, Blood, Choke, S/P	FSP	AP4C	Received	DMMP, Dimethoate, AsCl3, CEES
Photo Ionization Detectors (PID) and Flame Ionization Detectors (FID)				
CWA, TIC	PID	MultiRAE	Received	H2O2, AsCl3, CEES



Example of AHRF Bench-Card for Colorimetric Test Kit

E.L.I.T.E.™

Kit Purpose:

The presence of explosives are detected.

Positive Results:

Pink and/or Reddish Color



E.L.I.T.E. DETECTION COLOR CHART

	A	HEAT	B	C
NITRO-AROMATICS				
TNT	*	HEAT	HEAT	HEAT
2,4-Dinitrobenzene (DNT)	*	HEAT	HEAT	HEAT
2,6- DNT		HEAT	HEAT	HEAT
2-A-4, 6-DNT	*	HEAT	HEAT	HEAT
4-A-2, 6-DNT		HEAT	HEAT	HEAT
2-Nitrotoluene	*	HEAT	HEAT	HEAT
3-Nitrotoluene	*	HEAT	HEAT	HEAT
4-Nitrotoluene	*	HEAT	HEAT	HEAT
Tetryl		HEAT	HEAT	HEAT
1,3,5-Trinitrobenzene (TNB)		HEAT	HEAT	HEAT
1,3-Dinitrobenzene		HEAT	HEAT	HEAT
1,2-Dinitrobenzene		HEAT	HEAT	HEAT
Picric Acid		HEAT	HEAT	HEAT
TATB		HEAT	HEAT	HEAT
ALIPHATICS				
PETN			HEAT	HEAT
(Tri)Nitroglycerin			HEAT	HEAT
1,2-Dinitroglycerin			HEAT	HEAT
1,3-Dinitroglycerin			HEAT	HEAT
RDX			HEAT	HEAT
HMX			HEAT	HEAT
Dinitroethylene glycol			HEAT	HEAT
1,2,4-Butanetriol trinitrate			HEAT	HEAT
1,2,4-Butanetriol-1,4-dinitrate			HEAT	HEAT
1,2-Propanediol dinitrate			HEAT	HEAT
Nitrocellulose			HEAT	HEAT
1-Mononitroglycerin			HEAT	HEAT
NITRATES				
ANFO			HEAT	HEAT
Black Powder			HEAT	HEAT
Nitrated Urea			HEAT	HEAT

* Mild color may be visible in Step A, depending on amount of explosive

Negative Results:

*No Color Change
Tan Color*





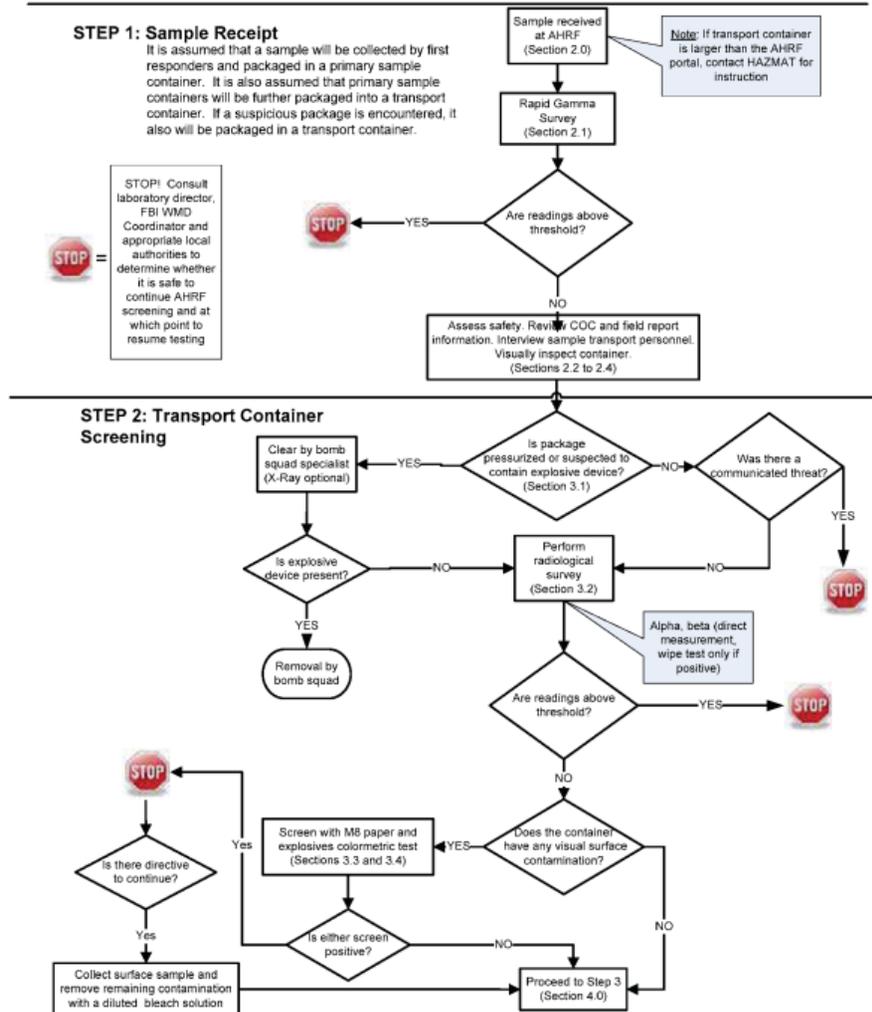
AHRF Screening Protocol for Known Threat Agents

Chemical Warfare Agents	Explosive Agents
Nerve: GA - Tabun GB - Sarin GD - Soman Organophosphate nerve agents VX Blister: H - Mustard agents HD - Distilled mustard HN - Nitrogen mustard HT - Sulfur mustard Lewisite Blood: AC - Hydrogen cyanide CK - Cyanogen chloride Choking: CG - Phosgene Chemical compounds Arsine Arsenic Chlorine Cyanide Fluoride Hydrocyanic acid Hydrogen sulfide Oxidizers	Ammonium nitrate Barium nitrate Black Powder Bromides DNT - Dinitrotoluene EGDN - Ethylene glycol dinitrate HMTD - Hexamethylenetriperoxidetiamine HMX - Octogen Lead styphnate Nitro cellulose Nitro glycerin PETN - Pentaerythritol tetranitrate Picric acid Potassium chlorate Potassium nitrate RDX - Cyclonite Semtex Smokeless powder Sodium chlorate Sodium nitrate TATP - Triacetone-triperoxide Tetryl TNB - Trinitrobenzene TNT - Trinitrotoluene Tri nitro naphthalene
	Radiological Agents
	Alpha and Beta particles Gamma ray emission



AHRF Screening Protocol for Initial 2-steps of 5-step Process

Recommended AHRF Screening Process





AHRF Screening Protocol Adapted to AHRAL Glove Box Train

Sample Acceptance and Transport Container Screen Example

Prior to sample acceptance:

- Set-up glove boxes for sample screen
- Turn on instruments
- Background radiation measurements (gamma, alpha, beta)

Receipt Chamber:

- Document inspection
- Radiation screen (micrometer?)
- Sample acceptance decision & assign sample ID

Glove box 1: Unopened transport container screen

- Gamma, alpha, & beta measurements
- Image container
- Look for surface contamination & collect surface residue if present
- M8 paper screen for outside of the sample

Opened transport container screen (headspace)

- LCD3.3
- AP4C
- MultiRae
- Alpha, beta screen

Remove primary/sample container from transport container

- Image & temperature primary/sample container
- M8 paper screen of container surface
- E.L.I.T.E explosive test of container surface

Open primary/sample container

- LCD3.3
- AP4C
- MultiRae
- Alpha, beta screen
- Move sample into glove box 3

Glove Box 1		
Accept Sample & Begin Transport Container Screening		
Is package <u>pressurized</u> or suspected to contain an <u>explosive</u> ?		
YES _____	STOP! Have package cleared by Bomb Squad	
NO _____	x _____	Proceed with testing
Radiation Screening		
Gamma Screen (SAM 935)	Reading: _____ 0.007 mR/hr	γ Threshold: 0.1 mR/hr
If positive STOP! Mitigate Hazard & Consult with Director		
Alpha Screen 2X Background (Ludlum 2360)	Bkgd Reading: _____ 0	Reading: _____ 0
If positive Complete Wipe Test		
Alpha Wipe Test Reading: _____		α Threshold: 220dpm/100cm³
Beta Screen 2X Background (Ludlum 2360)	Bkgd Reading: _____ 100	Reading: _____ 100
If positive Complete Wipe Test		
Beta Wipe Test Reading: _____		β Threshold: 2200dpm/100cm³
If Direct or Wipe Screen Tests above thresholds STOP! Testing and determine if safe to cont.		
If readings are below threshold proceed with testing		
Visual Inspection of Transport Container Screening		
Take picture of Transport Container _____ x _____		
Does container have surface contamination?		
Yes _____	No _____	x _____
Screen with M8 Paper		
M8 Paper Results: _____ Negative _____		
Yellow = G Nerve Agent	Dark Green = V Nerve Agent	Red = H Blister Agent
M8 Paper Test Positive:		Collect surface sample & remove remaining contamination with bleach solution before proceeding to Primary Sample Container Screen
M8 Paper Test Negative:		Proceed to Primary Sample Container Screening

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CDPH All Hazards Risk Assessment Laboratory (AHRAL) Post AHRF Certification

- Primary support as US EPA Region 9 Laboratory All Hazards Receipt Facility (AHRF) utilizing existing nationally accepted screening protocols
- On-going federal support for dedicated AHRAL resources to ensure a state of constant AHRF readiness
- Further refinement of AHRF workflow adaption to AHRAL facilities
- Develop electronic screening results reporting including image/video/audio capture
- Quarterly sample receipt and screening exercises with US EPA Region 9 Laboratory
- Utilize advanced micro-spectroscopy methods under development at EHLB to identify substances unclassified by AHRF screening

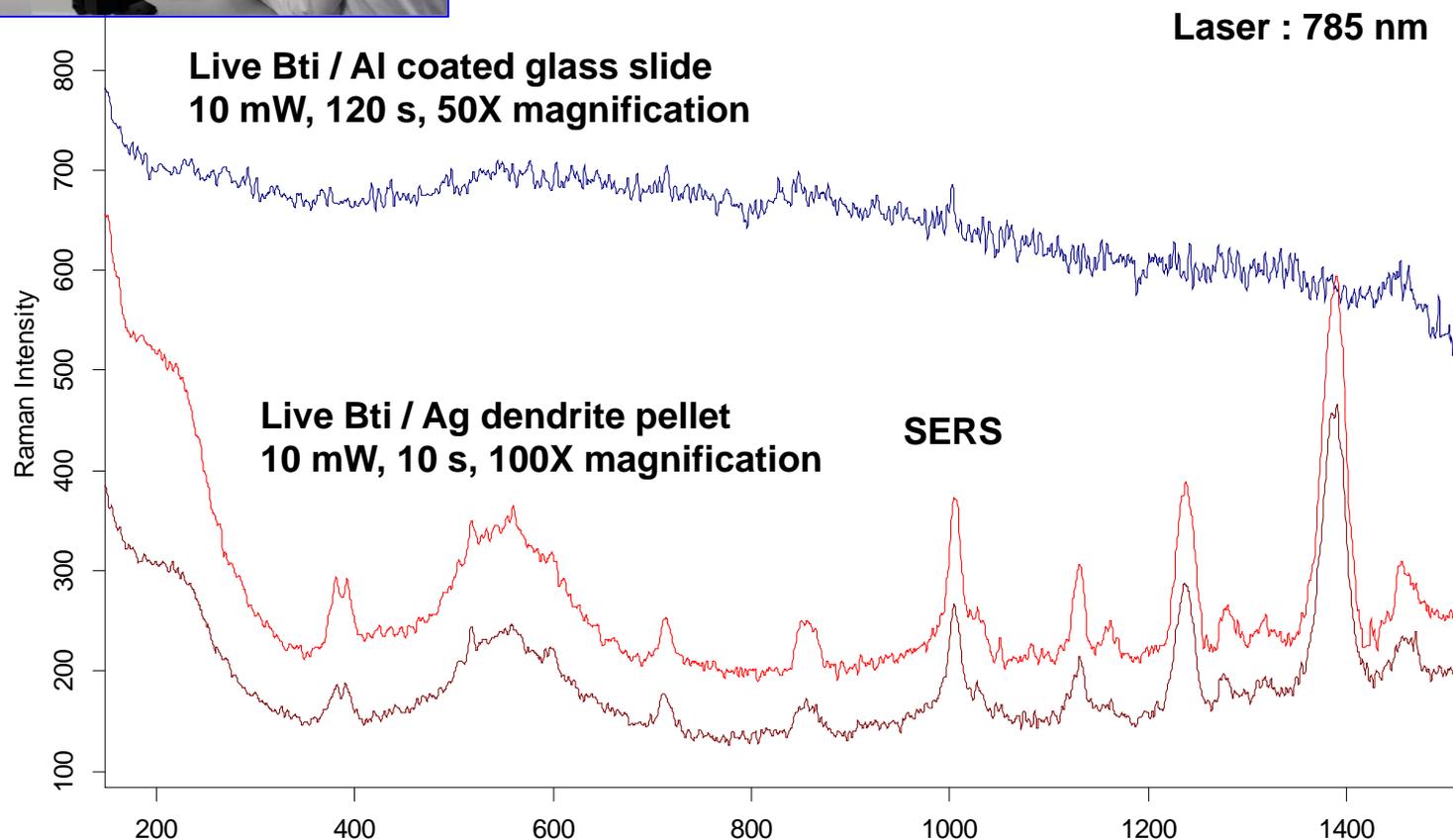


Advanced micro-spectroscopy methods for CBRNE

Example of Raman Microscopy for Biological Threat Agent



BTi is a safe chemical surrogate for Anthrax bacteria





Chemical Release Field Response

Specialized Emergency Mobile Laboratory (EML) to identify chemical and radiation threat agents, including those from suspected chemical terrorism (CT) incidents, in support of hospital preparedness and response, to ensure an adequate margin of safety for the public health.

Chemical Vapor Identification



Mystery Powder Identification



Combustion Source Detection



Criteria Air Pollutants



Chemical Sensor Transporter