

Chemical Emergency Response Activities in Wisconsin



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It Was Just a Normal Day...

- ...off the coast of Massachusetts fishing for clams.
- They pulled in their catch...



Until it Wasn't

- ...and things got interesting in a bad way.

WMDs close to home

Key to chemicals

- Arsenic trioxide
- Hydrogen cyanide
- Lewisite
- Mustard gas
- Nerve gas
- Phosgene
- White phosphorus

Known dumpsites in the Pacific

Chemical weapons dumped at Bikini in 1944 and 1945. The exact locations of these sites are unknown.

The Pre-LRNC Years

- LRN-B formation, 1990's
- Amerithrax 2001
 - Not anthrax, what is it?
 - Collect, transport, handle safely?
- What about chemical exposures?
 - Methods, materials, capacity?
 - Lab comparability assured?

Potential anthrax specimens received at the WSLH by day of submission, Wisconsin, 2001-2002. (n=585)

Date of submission	# specimens received
10/1/01	12
10/18/01	26
10/25/01	63
11/1/01	44
11/8/01	35
11/15/01	2
11/22/01	2
11/29/01	14
12/6/01	14
12/13/01	52
12/20/01	4
12/27/01	4
1/3/02	11
1/10/02	1
1/17/02	1
1/24/02	2
1/31/02	2
2/7/02	1
2/14/02	1
2/21/02	1
2/28/02	1
3/6/02	1
3/13/02	1
3/20/02	1
3/27/02	1
4/3/02	1
4/10/02	1
4/17/02	1
4/24/02	1
5/1/02	1
5/8/02	1
5/15/02	1
5/22/02	1
5/29/02	1
6/5/02	1
6/12/02	1
6/19/02	1
6/26/02	1
7/3/02	1
7/10/02	1
7/17/02	1
7/24/02	1
7/31/02	1
8/7/02	1
8/14/02	1
8/21/02	1
8/28/02	1
9/4/02	1
9/11/02	1
9/18/02	1
9/25/02	1
10/2/02	1
10/9/02	1
10/16/02	1
10/23/02	1
10/30/02	1
11/6/02	1
11/13/02	1
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12/4/02	1
12/11/02	1
12/18/02	1
12/25/02	1

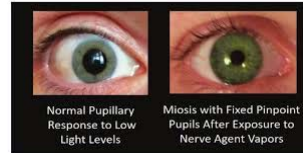
President Obama
The White House
Washington, D.C.

Sen. Roger Wicker
U.S. Capitol
Washington, D.C.

LRNC History



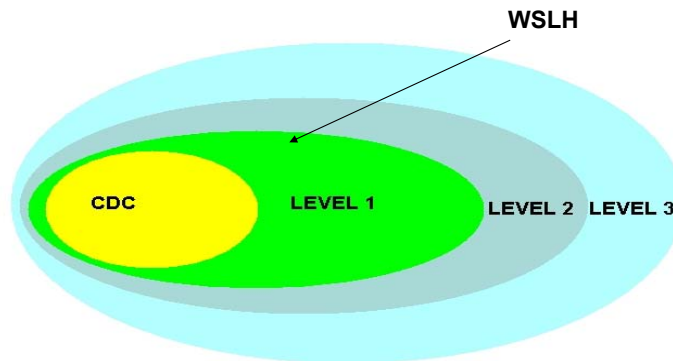
- Tokyo Sarin attacks
 - Matsumoto & subway
- 1999 CDC initiates exposure testing, funds labs CA, MI, NY, VA
 - NM 2000
- Focus area D evolves to the LRNC, Level 1, 2, & 3
- 5 addt'l L 1 labs added 2006
- Demonstrated capability and capacity for WMD exp.
- Greatly improved resources for all PH/env. work



Laboratory Response Network for Chemical Events (LRN-C)



- Limited to state & National PH labs



Chem Laboratory Role in PHP/PHER

- Human Exposure testing
 - WMD & other identified threat agents
- Environmental sample testing
 - Frequently integrated into normal lab activities
- Analytical & technical support for WI responders
 - Hazmat, 54th CST
 - FBI, USPIS
 - State & Local health
- Food testing
 - Radiological agents



WSLH Level 1 Lab Requirements

- Model is the Tokyo subway attack.
 - 12 killed, ~1000 exposures
 - 10,000 “worried well”
- Maintain infrastructure to test 1000 specimens
 - For all LRN tests
- Initiation of testing & 24/7 operation
 - Within 24 hour notification window



MIDDLE EAST
New Report of ISIS Using Poison Gas in Syria
 by KAHAR BOKHRIE AND CERIAN YODINI | 05.12.2015

ISTANBUL — The Islamic State says it has used chemical agents in an attack against civilians and rival insurgents in northern Syria late last week, according to local rebels and an international aid group.

DAILY Mirror
 Coteen calls in police over troll rape threat
SYRIA MASSACRE HORROR
NOW THEY'RE GASSING CHILDREN
 Chemical weapons kill 1,300, say rebels

Briefing
 December 2015
 ISIL/Da'esh and 'non-conventional' weapons of terror

ISIL CHEMICAL WEAPONS REPORTS

IRAQ
 Mosul
 Makhmour
 Possible chemical weapons attack
 Baghdad

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Chemical Threat Agents

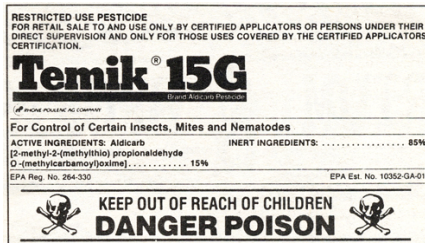
- Classes of Agents
 - Nerve Agents
 - Plant-derived toxins
 - Vesicants (blister & choking agents)
 - Metals & other elemental toxins
 - Volatile organics
 - Drugs
- Compounds quickly metabolized/degraded
 - Requires measurement of metabolites and/or biomarkers
- Limited impact on medical treatment
 - Results downstream of symptoms, limited tox data
 - Value in reassuring worried well, epi
 - Likelihood of attack considered

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WSLH Testing Capabilities



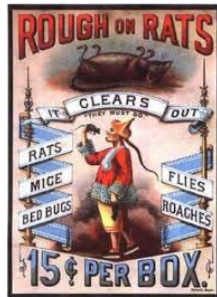
- Organophosphorus Nerve Agent metabolite panel (urine and blood)
 - Sarin, Soman, VX, Russian VX, cyclohexylsarin
 - Organophosphorus insecticides, e.g. parathion, malathion, chlorpyrifos, diazinon
 - Cholinesterase inhibition
 - Phosphonic acid metabolites measured
- Carbamates (urine)
 - Aldicarb & metabolites



WSLH Level 1 Lab Capabilities



- Tetramine (tetramethylenedisulfotetramine)
 - γ aminobutyric acid receptor antagonist
 - WHO top 10 causes of death in China (age 5-29)
- Trace Elements panel of 8 in urine, 3 in blood
 - Urine Be, As, Cd, Ba, Pb, Hg, Tl, ^{238}U , blood Cd, Hg, Pb
 - WI arsenic poisoning case



WSLH Testing Capabilities



- Vesicant Nitrogen Mustard metabolite panel
 - Chemotherapy agent *and* chemical weapon
- Vesicant Sulfur Mustard metabolite
 - 1,1-sulfonylbis(2-(methylsulfynyl)ethane (SBMTE)
- Lewisite metabolite (CVAA)



WSLH Testing Capabilities



- Abrine and Ricinine
 - Plant-derived toxins, castor beans and rosary peas
 - Abrin toxicity 75X ricin
- α Amanitin
 - Similar to commercial mushrooms in appearance
 - Hepatotoxin
- Cyanotoxins
 - Water, urine planned



WSLH Testing Capabilities



- Tetranitromethane metabolite
 - 4-Hydroxy 3-Nitrophenylacetic Acid (HNPAAC)
- Cyanide
 - Firefighter research
- Volatile Organics
 - 10 quantified, ~60 determined
- Long-acting anticoagulants



Other WSLH Analytical Testing Support



- Multiple Testing Categories/configurations:
 - Routine, established tests
 - May be regulated or for research/Epi
 - New tests performed by LRN for other programs
 - Utilizing instruments & expertise
 - Limited term/single purpose research
 - Wide array of tests developed



WSLH Programs Benefitting:

- Environmental Organic & Inorganic Chemistry
 - E.g. **PFAS**, PPCP, PAHs, air pollution tracers, etc.
 - Aquatic plant nutrients, BOD, spill investigations
- OIS
 - LIMS administration
- Forensic Toxicology
 - Anesthetic panel, VOCs, CN
- Biochemical Genetics
 - Organic acids
- WSLH PT program (Lab Improvement Division)
 - Sample preparation/verification
- Occupational Health
 - E.g nitrosamines in air



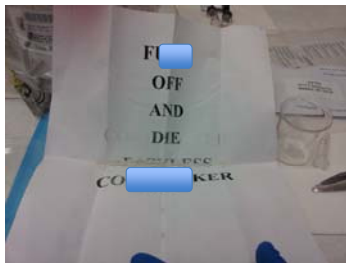
Responder Support & Related Activities

- Analytical & technical support for responders
- State-asset hazmat
 - Unknown substance characterization
 - Collection materials & protocols
 - Communication liaisons with law enforcement and health partners
 - CUEP-chem unknown eval prog.
 - Training & reachback

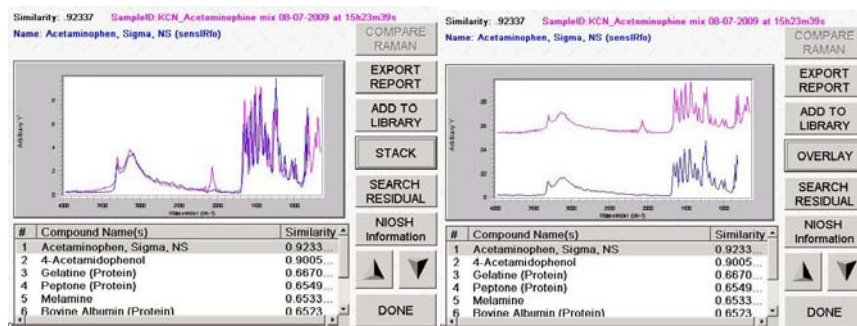


Unknown Substance Investigation

- “White Powder” investigations
 - May actually involve solids, liquids, or vapors
 - Bio and chemical threat agents
- WI Unknown substance protocol
 - Consideration of threat & health risk
- When and when not to submit to WSLH
 - Rad and explosive screening



Field Result Interpretation



92% Acetaminophen spectral match

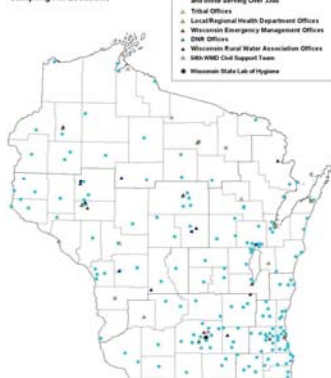
Extra peak = KCN

Env. Sample Collection Resources

- Emergency Response Drinking water sampling kits
 - Testing for rad, bio, chem
 - Sited all over state
 - Used October 2018



Emergency Drinking Water Sampling Kit Locations




Equipment Loan Program

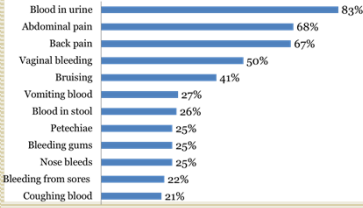
- WSLH/DHS Equipment Loan Program
 - Field monitors maintained for use by health, safety, and other investigators
 - NO₂, H₂S, H₂CO, Hg, NH₃, Cl₂, VOCs, XRF, etc.
 - Instrumentation recently refreshed





Fake Dope and Rat Poison




- Reports of unexplained coagulopathy in Chicago
 - Nasty constellation of symptoms
- Linked to synthetic cannabinoid use
- Brodifacoum exposure discovered
- Testing confirms brodifacoum in botanical material.
- 12 states, >320 cases, ~10 fatalities



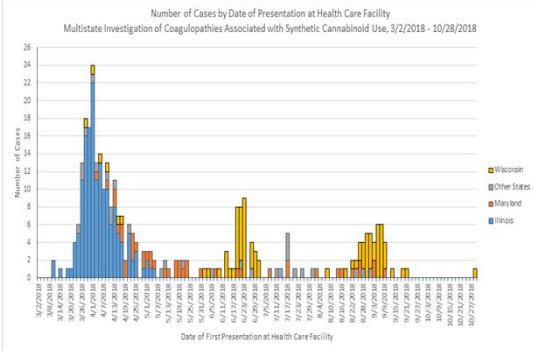
Symptom	Percentage
Blood in urine	83%
Abdominal pain	68%
Back pain	67%
Vaginal bleeding	50%
Bruising	41%
Vomiting blood	27%
Blood in stool	26%
Petechiae	25%
Bleeding gums	25%
Nose bleeds	25%
Bleeding from sores	22%
Coughing blood	21%

Timeline of Cases



- Treatable w/vitamin K
- No quantitative exposure testing available
- WSLH developed test, validated per CAP
 - Employed LCMSMS, labeled ISTD obtained from CDC
- Tested ~150 patients
- 2nd lab also developed capability
- Influenced duration of treatment



Number of Cases by Date of Presentation at Health Care Facility
Multistate Investigation of Coagulopathies Associated with Synthetic Cannabinoid Use, 3/2/2018 - 10/28/2018

Legend: Wisconsin (yellow), Other States (grey), Maryland (orange), Illinois (blue)

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EVALI



- First observed in WI, March 2019
- Peaked late summer, 50 states, >2800 hospitalized, ~70 fatalities
- WSLH role largely facilitation
 - Coordination with WDPH
 - Accepted submissions from LPH, LE, clinical labs, and pathologists
 - Developed proper collection, packaging, and shipment information
 - Directed samples to FDA, CDC (two branches)
 - Assisted with result interpretation



Vaping in WI



- WSLH received:
 - ~200 vaping pods, devices, cartridges, 12 BAL specimens & 8 FFPE blocks, 1 package edibles, 2 dabs, 2 frozen lung tissue, 1 blood, 1 plasma, 1 sputum, 1 nasal swab
- Employed 2 LIMS, a big spreadsheet, DHS Redcap database
- Developed vitamin E acetate method
 - Tested ~50 samples, confirmed association w/2019 THC products (vs. 2018) and cases



Looking Ahead



- Shift towards blood, protein adducts
- Non-targeted screening
- Radiological exposures?
- Opioids and the LRN
- PFAS capability
- New and emergent threats
 - More EVALI-related?
 - Other unregulated products



Thanks! Any Questions?



- LRNC Staff
 - Karyn Blake
 - Meshel Lange
 - Nick Levitt
 - Erin Meinholz
 - Matt Roach
 - Brandon Shelton
 - Mason Shields
 - Noel Stanton

