Managing Emerging Threats to Public Safety and Healthcare Workers

Chemical Suicides

Aluminum Phosphide
Partners in Preparedness

- Inova Loudoun Hospital/Inova Health System
- Loudoun County Fire, Rescue, and Emergency Management
- Loudoun County Sheriff’s Department
- Loudoun County Office of Emergency Management
- Virginia Office of Medical Examiner
- Virginia Department of Emergency Management
- Northern Virginia Hospital Alliance
Introduction and Overview

• Loudoun County Fire & Rescue:
  – Cover 520 square miles
  – Combination department with 475 employees and approximately 800 volunteers
  – Member of COG and NOVA
  – Mutual aid with Virginia (4), West Virginia (1), Maryland (3), & MWAA-Washington Dulles
Operations Division

• 374 personnel
• 3 – Battalions
  • Battalion 601 (5 stations - Ashburn-Sterling area)
  • Battalion 602 (9 stations – Leesburg, Hamilton, Purcellville, Round Hill, Neersville, Lovettsville, Lucketts)
  • Battalion 603 (5 stations – South Riding, Arcola, Aldie, Middleburg, Philomont)
Operations Division

• Daily Staffing
  – Monday-Friday, 0600-1800 hrs. = 113
  – Saturday & Sunday, 0600-1800 hrs. = 90
  – 1800-0600 hrs./7 days a week = 52

• 17-Engines, 5-Trucks, 11-Tankers, 4-Rescue Squads, 8-Medic units, 7-BLS Ambulances, MAU, MAB, Haz-Mat, Swiftwater, Wildland trailer
Operations Division

- Hazardous Materials Team
  - Career Battalion Chiefs assigned to Battalion 603
  - Career staff at Dulles South – FS619 (24/7)
  - Engine/Truck/Ambulance crew cross-staff
  - Haz-Mat truck, 2-Haz-Mat support vehicles, 2-Decon trailers
May 2009 Incident

- “Overdose” at an area hotel
- No “Red Flags”
- Ingested Aluminum Phosphide
- Patient treated and expired on the 12th
- 0.2 ppm Phosphine detected in ER
- Tablets and container bagged with body
May 2009 cont’d

- Next day returned due to concerns of the bagged tablets
- HazMat personnel made entry
- Zero readings on the PID
- Unused tablets and container bagged and over packed / disposal drum
December 2011 - 911 Call

- Called in by son who was with the patient
- Language challenges
  - 911 Call taker needs to have patience
  - Civilians might not always understand what we are asking
- Family stated she had taken “rat poison”
• Family stated she had brought this in from another country
• History of depression
• Patient often talked of suicide
• Caller coughed frequently through call
Initial EMS Incident

• Dispatched at 05:45 for the overdose
• Patient had ingested 4 tablets of “Rat Poison”
• These were intentionally ingested 30-60 minutes prior to arrival of EMS
• Truck Officer identified Aluminum Phosphide tablets from 2009 suicide in Sterling
EMS Incident (cont’d)

- Medic unit departed at 06:00
- Conscious throughout EMS portion
- Vitals stable throughout EMS portion
- C/O severe abdominal pain
- Established 2 IV’s
- No changes while en route
- Arrived at ER 06:22
HazMat Involvement

- Truck Officer briefed his Battalion Chief
- Pulled MSDS for Aluminum Phosphide
- Contact made to BC 601
- BC 601 went to hospital to assess situation
Aluminum Phosphide

• Widely used in other countries for pest control in food supplies

• In Iran it is known as the “rice tablet”

• Available in US for use by certified pest control agencies

• Easily brought into country
Aluminum Phosphide

- 2 cases of suicide with this substance in Loudoun County alone in a little over 2 years
- Converts to Phosphine when wet
- Widely used in India and Iran for suicide
Aluminum Phosphide

- Tablets can be green, grey or brown
- Contains 56% AP and 44% aluminum carbonate/ammonium carbonate
- Might have a garlic odor
Aluminum Phosphide

- Severity depends on dose and condition of the tablets themselves
- Once ingested it excretes phosphine through the kidneys and lungs
- Releases 1g of phosphine with moisture
- Lethal Does 0.15g – 0.50g *
Phosphine

- PH3
- OSHA TWA: 0.3ppm
- IDLH: 50ppm
- Colorless gas
- Fruity or garlic odor
Phosphine

- LEL: 1.79%  UEL: 98%  
- Inhalation hazard, respiratory tract irritation, CNS Depression  
- Headache, dizziness, difficulty breathing, nausea, weakness, and chest pain
Phosphine, Resp. Protection

- **Up to 3 ppm**: Any supplied-air respirator
- **Up to 7.5 ppm**: Any supplied-air respirator operated in a continuous-flow mode
- **Up to 15 ppm**: Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern
  - Any self-contained breathing apparatus with a full facepiece
  - Any supplied-air respirator with a full facepiece
- **Up to 50 ppm**: Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode
Aluminum Phosphide
What do you do when your hazardous chemical is INSIDE your patient?
Inova Loudoun Hospital

- 183 bed Acute Care Community Hospital
- 25 bed Adult ED
- 11 bed Pediatric ED
- Currently the only hospital in Loudoun County
- 12 miles from Dulles International Airport
Hospital Response overview
(December 27, 2011 case)

• On arrival @ 0620, patient was first placed into a critical care treatment room
  (Poison Control had been contacted and there was no “red flag” to isolate this patient)

• The patient was awake but not talking at time of arrival to ED.

• Rapid cardiovascular decompensation ensued.
Medical Interventions

Critical Care Interventions in first 45 minutes:
- Endotracheal intubation
- Mechanical ventilation
- Nasogastric intubation
- Continuous cardiac monitoring
- Profound hypotension => pressor drugs
- Central IV access and arterial access
Cellular level actions of Phosphine

- Interrupts mitochondrial activity
- Hypomagnesaemia
- Severe acidosis
- Renal clearance = acute renal failure
- Rapid multi-organ failure
• Cardiac arrhythmias due to myocardial injury.
• After absorption oxidized to ox acids and excreted in urine as a hypophosphosphate. (non-toxic)
• However, excreted in lungs unchanged
Typical Medical Course of Aluminum Phosphide ingestion

• Symptoms occur within ½ hr of ingestion

• Severity is dependent on toxicity and number of tablets

• Patient may be awake initially, but rapid multiple-organ failure ensues
Medical Course cont.

- Early signs of ingestion are severe abdominal pain and vomiting
- Cardiovascular and respiratory collapse follow quickly
- There are documented cases of survival in cases where the pellets were old.
Medical Course cont.

- Metabolic Acidosis is profound
- There is no antidote.

***Some studies suggest gastric irrigation with Potassium Permanganate or coconut oil to mitigate damage within 2 hours of ingestion.

Activated charcoal may be used but no studies show evidence of clear results.
Moderate poisoning

- GI, Cardiovascular, Respiratory symptoms appear initially
- Later: Hepatic and renal failure
- DIC
- ARDS
- Survivors: 33% have dysphagia due to esophageal complications
NO CPR !!!

CPR IS **NOT** ADVISED

• This puts the 1st responder at great risk of exposure from the phosphine gas or pellet fragments.

*If patient is already in cardio-respiratory collapse, possibility of survival is 0%*
Gastric Management

• A closed-system gastric lavage MAY be done within 2 hours of ingestion.

• At no time should the gastric tube system be opened to the atmosphere once inserted.
Gastric Management cont.

- Stomach contents should be collected in a closed suction system, vented to the outside.

- Emesis should be immediately contained in plastic and removed to an outdoor location.
Spontaneous Combustion

2009 (Journal of Emergency Medicine), reported 2 cases in Iran of spontaneous combustion when inserting NG tube.

Both patients had flames, burning face and hair.

Both patients expired shortly after.
Staff reported “burning to eyes and skin”

• At approximately 0715, when this was reported by staff, the patient was quickly moved to a negative air flow room.

• Discussions ensued re. safe Personal Protective Equipment (PPE) and Fire Department Hazmat was contacted.
PPE

- Hospitals use Level C Personal Protective Equipment (PPE) for Hazmat

- The FR 57 filters are NOT approved by NIOSH for use in a Phosphine environment

- There are no alarms on hospital hazmat PAPRS to indicate when filters fail or become saturated
Hospital considerations

- Where and when to treat rests on confirmation of safe air readings and availability of negative air isolation room (or alternate outside site)

- “Walk-in’s” or unrecognized cases may necessitate an ER evacuation.
Ethics

- Deciding when to declare “Do Not Resuscitate” is case-dependent.

- What if it’s an accidental overdose?

- What if it’s a child?
Poison Control

• Poison Control did not have any “flags” for this being a potential Haz-mat substance.

• Virginia Dept. of Emergency Management has a 24/7 hotline for Chemical Hazmat queries

800–468-8892 or 804-674-2400
• Taking measurements of phosphine in the air was the single most important KEY action taken and guided the remaining responses.
Timeline of Patient at Hospital

0622: arrival to ED critical care room
0715: moved to negative air Isolation room
1003: moved to outside tent
1058: patient expired

NEXT DAY:

1500: body removed by medical examiner’s officials after completion of examination
Measuring Air levels of Phosphine

• Early request for Hazmat Technicians for air monitoring was essential

• In 2011 case, even with a closed gastric system, and closed airway system, the phosphine readings in the negative air flow room rose
Phosphine Detection

- RAE ppbRAE 3000 PID
- IP: 9.96 eV
- Specific Phosphine setting
- Emergency room detection
- Patient detection
Phosphine Detection

- Toxi RAE II
- Specific to phosphine
- Area detection
- Both ER Rooms
- Decon Tent
Drager Chips/Tubes

- Positive color change with tubes
  - We carry both types

- Chips:
  - 0.1-2.5ppm
  - 1-25ppm
  - 20-500ppm

- Tubes
  - 0.1-4ppm
  - 15-1000ppm
Phosphine Readings

0830: critical care room: .497ppm
  (pt had been gone from this room for at least 1 hour)

0842: neg air isolation .023 ppm
0858: neg air isolation .035 ppm
0921: neg air isolation .187 ppm
1021: neg air isolation .475 ppm

Patient was moved to tent at 10:03
Negative Air Pressure Room
(0715 – 1000)
(Pt’s 2nd room)

Critical Care Room 2
(0620-0715)
(Pt’s 1st room)

Critical Care Room 1

Nursing Station

EMS Parking Area

Emergency Department

Hazmat Tent

EMS Entrance

Pt Flow
Tent Setup

- Hospital respirator
- Hospital IV pump
- Cardiac monitor
Tent Setup

• Portable generator was utilized
  – Generator was noisy
  – Maximize distance from tent
  – Consider generator exhaust

• Portable heating system used
  – Make sure to utilize the thermostat
  – Provided constant flow of air
Tent Setup

• Need to consider warmer weather

• Lighting established
  – Suspended from ceiling area

• Facility built ramp for hospital stretcher

• LCSO tracked everyone in/out
Phosphine levels in tent

- Gastric tube removed per hospital protocol

- 1257: 112 ppm
- 1500: 90 ppm

NEXT DAY:
- 0800: 0 ppm
Post Mortem

• Don’t put body in morgue for at least 24 hours

• **Unified** decision to leave in tent
  – Concerns

• Armed presence

• Hid patient in plain site
Law Enforcement

- Since this was a suicide, who actually had custody of the body
- Who would transport the body
- Had to control the house until HM arrived
- Need for awareness training
ME Issues

• Communication problems
• Take vs. No Take
• Never spoke w/ME directly
• Issues with mitigation attempts
  – Activated Charcoal
  – Water Lavage
• Examined body on scene with VDEM HMO
Unified Command

• Coordination between Fire/EMS, Law Enforcement & Hospital is a must

• Potential, as well as actual issues, will be decided all together

• Protection of personnel and facilities is primary goal

• Joint PIO’s
Command Considerations

• Be ready for media
  – We got lucky

• Limited the amount of information over radio

• Need to consider legal for actions
  – Family not allowed to touch deceased
  – Body moved and stored outside
Considerations

- Ambulance ventilation concerns
- Special precautions during transport
- Religious/Cultural beliefs
- Family wishes
- Social media and responders
- Media
Where We Are Now

• Workgroup was developed
• Want to increase responder awareness
• Early notification to HM is crucial
• Developing methods for safe transport
Where We Are Now

• Research for Protocol revision under way
  – Treat vs. No Treat
• Researching legal ramifications for a no treat policy
• Strengthening partnerships
  – Law Enforcement
  – Hospital / ME Office
Lessons Learned

Internal Incident Command response

Too many people in resuscitation room for this type of patient (in and out)

Is our Level C PPE adequate – questions remain

Utilizing technical experts = decisions easier to make
UNIFIED COMMAND WORKS!!!
Not All Superheroes wear capes…….
Questions ?