Chemical Suicides

Managing Emerging Threats to Public Safety and Healthcare Workers

Aluminum Phosphide

INOVA® LOUDOUN HOSPITAL

LOUDOUN COUNTY VIRGINIA FIRE-RESCUE

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

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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

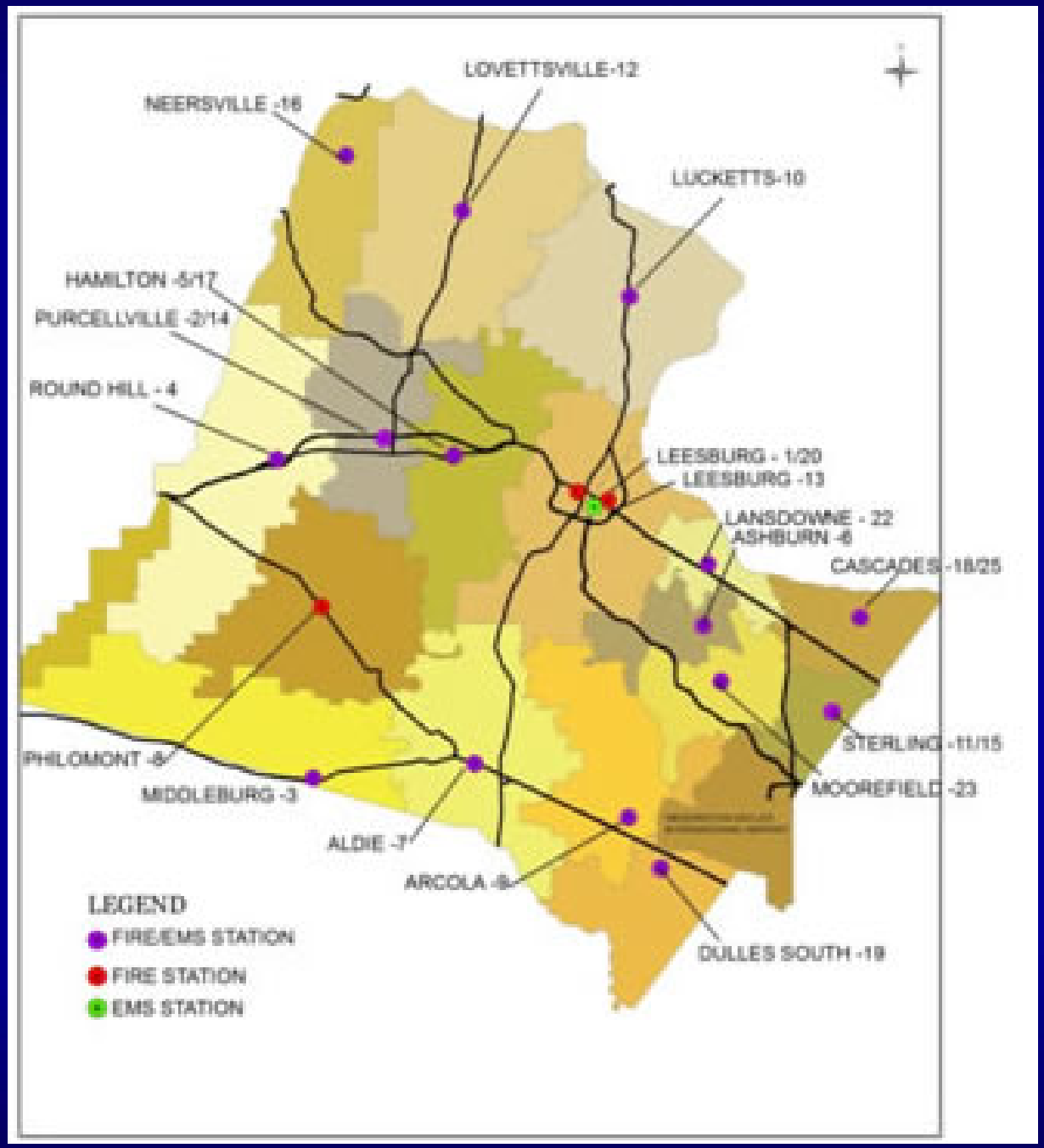
Operations Division

- 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


LOVETTSVILLE-12
NEERSVILLE -16
LUCKETTS-10
HAMILTON -5/17
PURCELLVILLE -2/14
ROUND HILL - 4
LEESBURG - 1/20
LEESBURG -13
LANSDOWNE - 22
ASHBURN -6
CASCADES -18/25
STERLING -11/15
MOOREFIELD -23
PHILOMONT -8
MIDDLEBURG -3
ALDIE -7
ARCOLA -8
DULLES SOUTH -19
LEGEND
FIRE/EMS STATION
FIRE STATION
EMS STATION

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”

911 Call cont'd

- 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?

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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

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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.

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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**

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Cellular level actions of Phosphine

- Interrupts mitochondrial activity
- Hypomagnesaemia
- Severe acidosis
- Renal clearance = acute renal failure
- Rapid multi-organ failure

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- **Cardiac arrhythmias due to myocardial injury.**
- **After absorption oxidized to ox acids and excreted in urine as a hypophosphite. (non-toxic)**
- **However, excreted in lungs unchanged**

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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

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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.

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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

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Moderate poisoning

- GI, Cardiovascular, Respiratory symptoms appear initially
- Later: Hepatic and renal failure
- DIC
- ARDS
- Survivors: 33% have dysphagia due to espohageal complications

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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%

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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.

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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.

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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

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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.**

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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

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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.

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Ethics

- Deciding when to declare “Do Not Resuscitate” is case-dependent.
- What if it’s an accidental overdose?
- What if it’s a child?

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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

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Turning Point

- Taking measurements of phosphine in the air was the single most important KEY action taken and guided the remaining responses.

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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

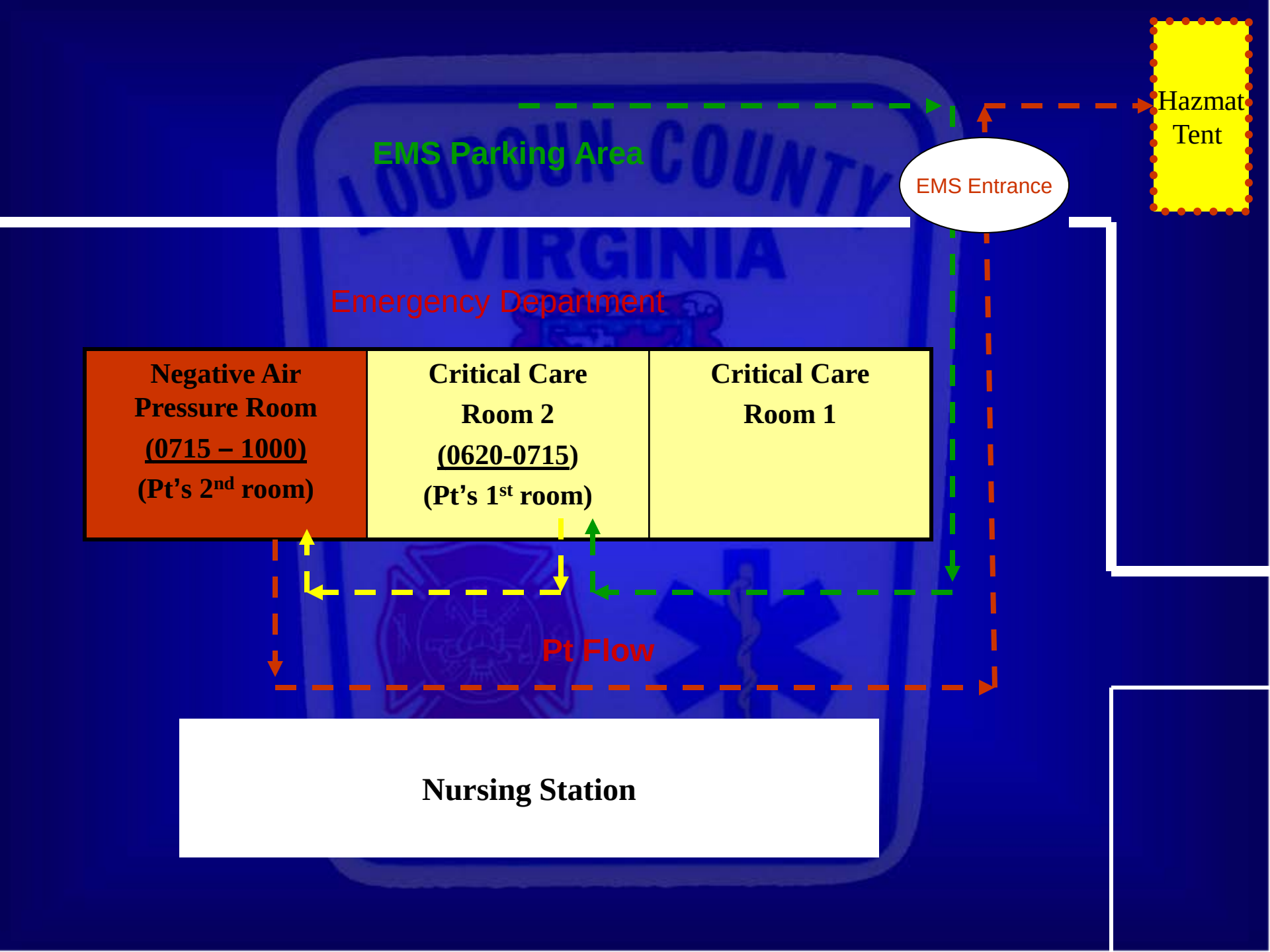
0921: neg air isolation .187 ppm

1021: neg air isolation .475 ppm

Patient was moved to tent at 10:03

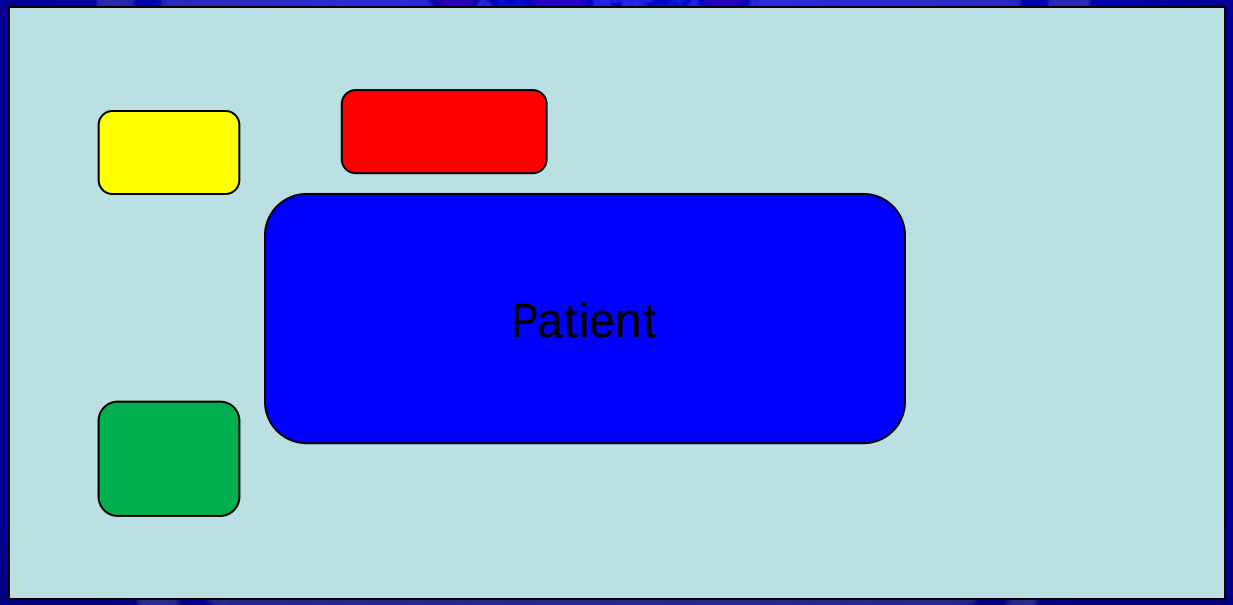
Decon Tent


Loudoun County Department of
Fire, Rescue and Emergency Management


Hazmat Tent
EMS Parking Area
EMS Entrance
Emergency Department
Negative Air Pressure Room (0715 – 1000) (Pt's 2nd room)
Critical Care Room 2 (0620-0715) (Pt's 1st room)
Critical Care Room 1
Pt Flow
Nursing Station

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

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UNIFIED COMMAND WORKS!!!

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Not All Superheroes wear capes……

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LOUDOUN COUNTY VIRGINIA FIRE-RESCUE

Questions ?

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