

Access the recorded webinar here:

<https://attendee.gotowebinar.com/recording/8381465392583456769>

Access speaker bios here:

<https://files.asprtracie.hhs.gov/documents/aspr-tracie-healthcare-challenges-after-chemical-incidents-webinar-speaker-bios.pdf>



TRACIE

HEALTHCARE EMERGENCY PREPAREDNESS
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Healthcare Challenges in Chemical Incidents

January 14, 2020

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ASPR TRACIE: Three Domains



- Self-service collection of audience-tailored materials
- Subject-specific, SME-reviewed “Topic Collections”
- Unpublished and SME peer-reviewed materials highlighting real-life tools and experiences



asprtracie.hhs.gov



- Personalized support and responses to requests for information and technical assistance
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1-844-5-TRACIE



- Area for password-protected discussion among vetted users in near real-time
- Ability to support chats and the peer-to-peer exchange of user-developed templates, plans, and other materials



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Duane Caneva, MD, MS
Chief Medical Officer
U.S. Department of Homeland Security



DHS at a Glance

- Approximately 240K personnel
- FY 2019 Budget Request: \$74B (direct appropriations, fees, disaster assistance)
- Core Missions of the Department:
 - Securing Our Borders
 - Enforcing Our Immigration Laws
 - Maritime Security
 - Critical Infrastructure Security and Resilience
 - Transportation Security
 - Disaster Preparedness and Resilience
 - Executive Protection/Financial Crimes



Large Department with Broad Authorities and Mission



Homeland
Security

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Countering Weapons of Mass Destruction

Chief Medical Officer Responsibilities



- *Serve as principal advisor* to DHS Secretary, the FEMA Administrator, the CWMD Assistant Secretary, and Department officials for medical and public health issues
- *Coordinate* with federal, state, local, tribal, and territorial governments, the medical community, and others outside the Department, such as CDC and HHS Assistant Secretary for Preparedness and Response (ASPR), *for medical and public health matters*
- Provide operational medical support to all components of the Department
- Provide medical expertise and support to front line operators/EMTs and for biodefense planning and preparedness



High Priority Projects and Areas of Focus

- Southwest border surge and public health best practices for border towns
- Ebola preparedness and enhanced medical screening at select ports of entry
- Community readiness/ WMD programs
 - BioWatch
 - Securing the Cities
 - Chemical incident preparedness
 - Fusion centers
- First Responder Vaccine Initiative (FRVI) Pilot
- EMS and law enforcement engagement
- CReDO—Community Response to Drug Overdose





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John Hick, MD
Hennepin Healthcare & ASPR Moderator



Webinar Objectives/ Setting Stage

- Webinar Objectives:
 - Discuss the potential effects of a chemical incident
 - Share recent guidance and lessons learned in assessing, triaging, and treating patients, including considerations for novel nerve agent treatment
- ASPR TRACIE Exchange Issue 9: Preparing for and Responding to Chemical Incidents
- ASPR TRACIE Chemical Hazards Topic Collection



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Susan Cibulsky, PhD
Senior Policy Analyst
HHS ASPR



HHS ASPR

- Public health and medical emergency support for a nation prepared
- Emergency management and medical operations
- Biomedical Advanced Research & Development Authority (BARDA)
- Strategic National Stockpile
- Information management, strategy, policy, planning, requirements

Interagency Coordination

- Within HHS:

- NIH
- CDC
- FDA



- Outside HHS

- DoD
- DHS
- DoS
- USDA
- VA
- ODNI

Introduction to Fourth Generation Agents (FGAs)

- What are FGAs?
- FGA characteristics
- Incident recognition
- PPE
- Patient decontamination

*There is no known threat of Fourth Generation Agent use in the United States

What Are Fourth Generation Agents?

- Fourth generation agents – aka Novichok, aka A-series agents
 - 1st generation chemical warfare agents: phosgene, chlorine, mustards
 - 2nd generation: G-series nerve agents (sarin, soman,...)
 - 3rd generation: V-series nerve agents (VX,...)
- Developed as weapon by Soviet Union to defeat Western countermeasures

What Are Fourth Generation Agents?

- A230
- A232
- A234
- FGAs are organophosphorus nerve agents
- FGAs inhibit acetylcholinesterase, causing cholinergic crisis
- Highly toxic/potent: similar to VX
- Unique characteristics pose challenges to response operations

FGA Characteristics

- Persistent in the environment
 - Low volatility – extremely low vapor pressure; 5-10x lower than VX
 - High water solubility
 - High chemical stability
- Likely to be encountered as liquid
- Absorbed through skin and mucus membranes
- Also toxic by inhalation or ingestion
- Limited data are available from research studies or real-world experiences

FGA Incident Recognition

Clinical Recognition

- Victim signs/symptoms may be first indication of FGA use
- FGAs cause cholinergic crisis, same toxidrome as other nerve agents
- Patients may demonstrate some combination of the following:
 - SLUDGE: Salivation, Lacrimation, Urination, Defecation, GI upset, Emesis
 - DUMBBELS: Defecation, Urination, Miosis/Muscle weakness, Bronchospasm/Bronchorrhea, Bradycardia, Emesis, Lacrimation, Salivation/Sweating
- Delay between skin exposure and symptom onset may be longer than for VX (several hours possibly up to 3 days)
- Victims may be far from point of exposure before symptoms occur

FGA Incident Recognition

Clinical Recognition – Salisbury, UK examples

- Initial presentations in Salisbury cases included only small # of symptoms of cholinergic crisis
 - Miosis, bradycardia, decreased level of consciousness
 - Other, common, exposures can cause these: alcohol, opioids, benzodiazepines
- Alerts about synthetic opioid overdose had just been issued
- Additional symptoms of cholinergic crisis developed over 1st 24 hours
 - Sweating in absence of fever, fluid loss, muscle fasciculations, profound bradycardia
- Delayed signs and symptoms highlight the importance of standard precautions at all times

FGAs: Personal Protective Equipment

- FGAs are highly potent; contacting small amounts can cause serious toxicity
- Responders must take measures to prevent any contact with:
 - Liquid agent
 - Suspected contaminated surfaces
 - Potentially contaminated people
- Patients may arrive at hospital before incident recognized
- Agent confirmation will take time
- Practice standard precautions

FGAs: Personal Protective Equipment

- PPE requirements are the same as for VX
- Follow your standard operating procedures for a nerve agent such as VX
- Adhere to appropriate PPE use, including strict discipline in doffing PPE procedures

FGAs: Decontamination of Patients

- Patient decontamination is a medical countermeasure
- Decontamination of skin and hair is critical in cases of exposure to liquid
- Absorption of FGAs through skin takes time; there appears to be a depot effect in skin
 - Decontamination may provide clinical benefit even when performed hours to days after exposure to liquid agent, although the earlier the decontamination, the better
 - Repeated decontamination may be necessary

FGAs: Decontamination of Patients

- Decontaminate with:
 - Soap and water
 - Reactive Skin Decontamination Lotion (RSDL) for spot decontamination
- FGAs are not readily degraded by water
 - Avoid direct contact with decontamination runoff
 - Contain runoff as soon as possible



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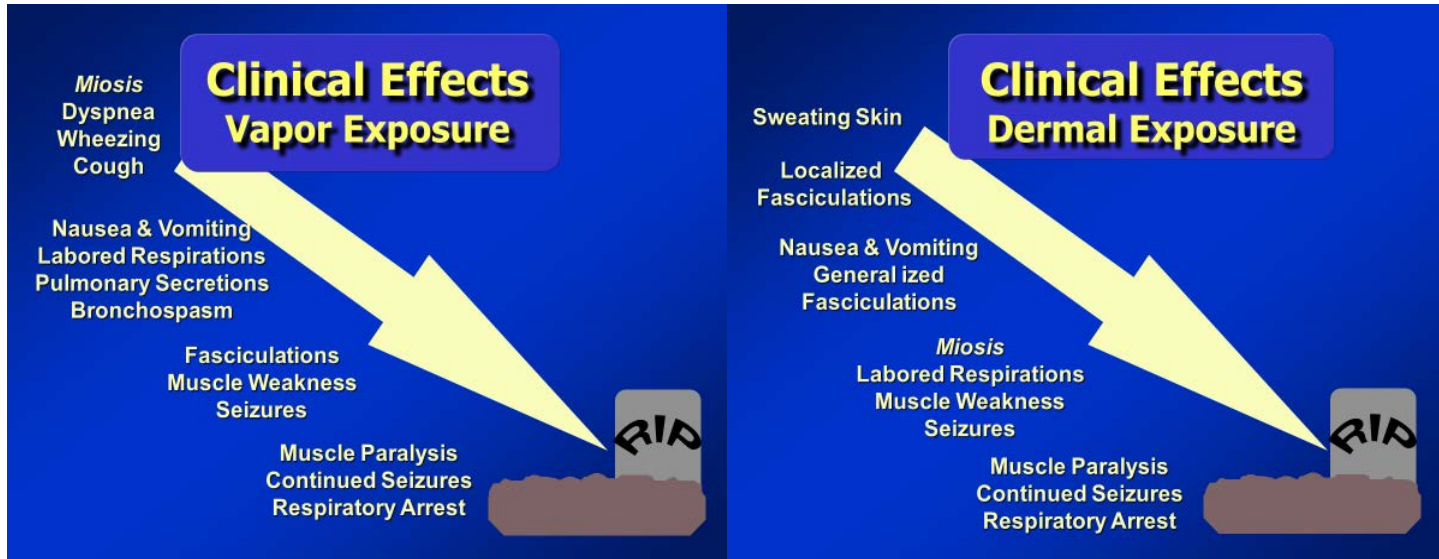
Mark Kirk, MD
Director, Chemical Defense Program
U.S. Department of Homeland Security



Key Messages

- Achievable goals: protecting healthcare staff and a positive health outcome for victims of FGA exposure
- How: meticulous attention to what we already know
 - Standard precautions with ALL patients with AMS
 - Supportive/symptomatic care before focusing on specialized treatments
 - If suspicious of acetylcholinesterase (ACHE) inhibitor poisoning, titrate antidotes to clinical effects regardless of which agent
- Expect FGAs will create unique challenges
 - Uncertainty of diagnosis
 - Prolonged intensive care management and large, repeated doses of antidotal therapy may be necessary (potential scarce resource scenario)

ACHE Inhibitors: OP insecticides and chemical warfare nerve agents cause variable clinical presentations



Nerve Agent Poisoning Treatment

- Decontamination / Self Protection
- Supportive Care
 - *Patients Die a Respiratory Death*
- Antidotes
 - Anticholinergics (Atropine)
 - Oxime AChE reactivators
 - Anticonvulsants (Benzodiazapines)



Clinical Course

EMS finds two individuals altered on a park bench

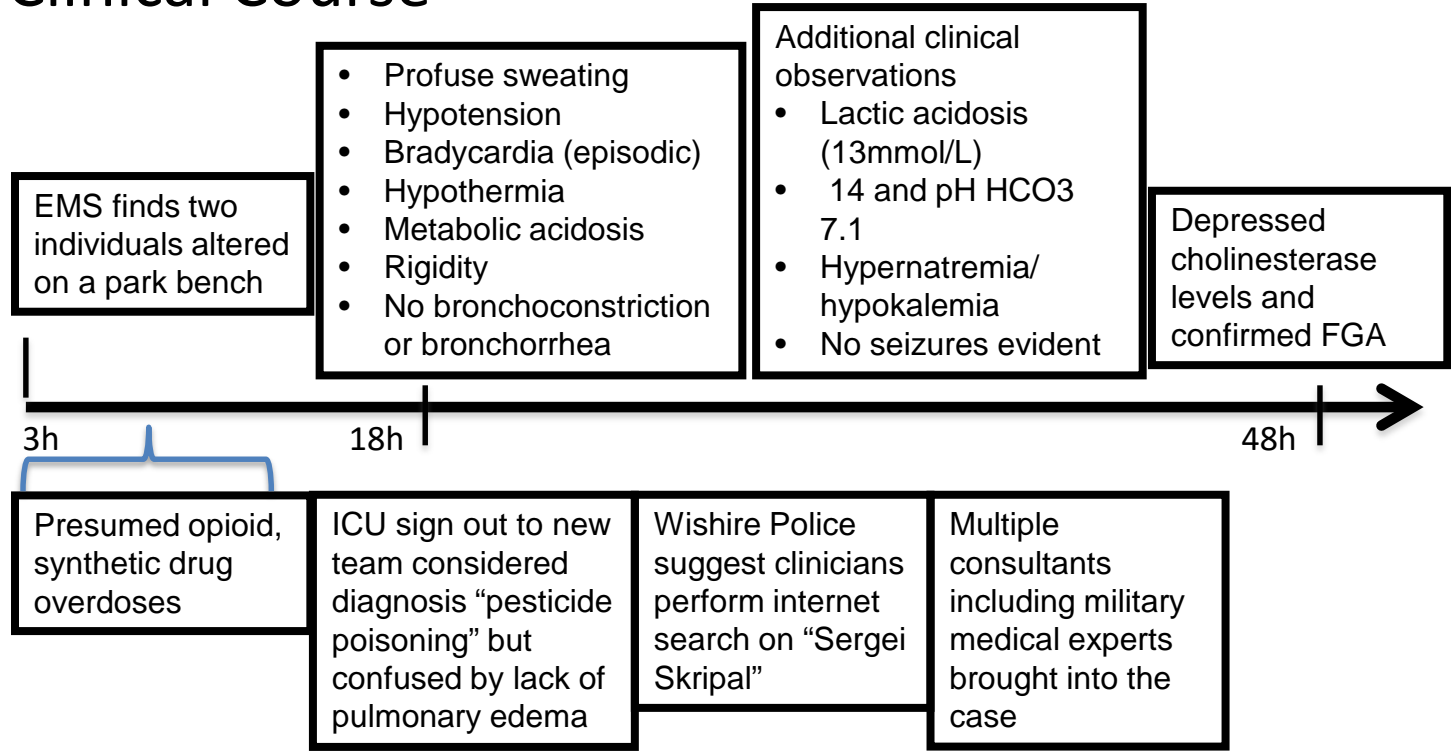
Patient 1

- Eyes open & staring
- 158/94;88;14
- Pinpoint pupils
- Increase motor tone
- Oral secretions
- Lungs clear
- Vomited (after naloxone)

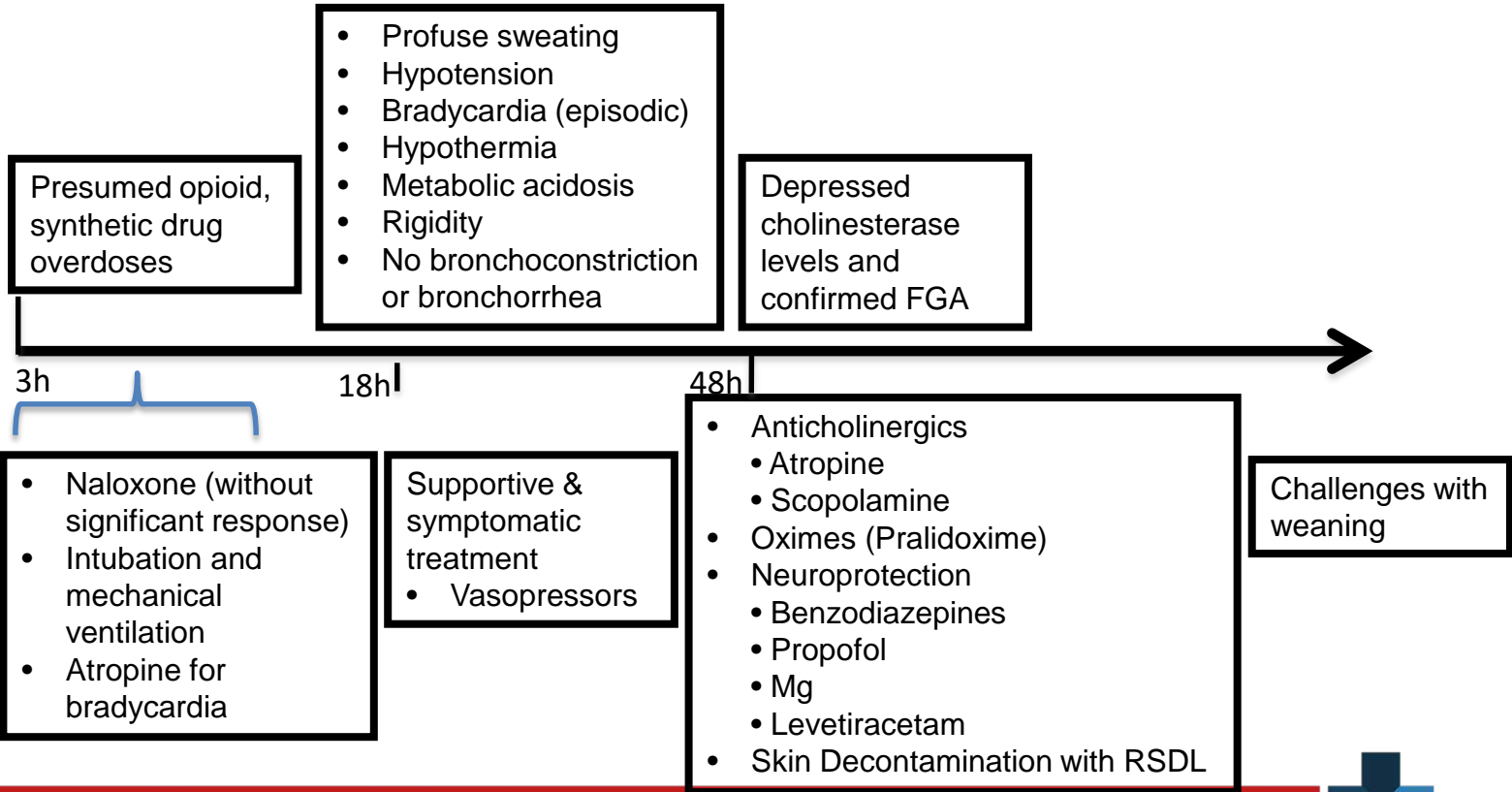
Patient 2

- Unconscious
- 164/90;42;Apneic
- Pinpoint pupils
- Oral secretions
- Lungs clear
- Trismus/fasciculations around mouth
- Flaccid limbs

Clinical Course



Clinical Course Treatment



FGA – Unique Clinical Pearls

- Latent period - many hours
 - Onset of symptoms may be delayed many hours
 - Slow progression of symptoms - obvious toxidrome evolves over many hours
- Expect clinical effects similar to other nerve agents
 - Expect requiring higher doses and prolonged use of repeated dosing
 - Lactic acidosis and hemodynamic instability
 - Seizures, bronchoconstriction, bronchorrhea not observed in patients

Other Considerations

- Additional Casualties
 - Police officer exposed during investigation
 - 2 people exposed from discovering perfume spray bottle in trash (1 death)
- Expert Consultation
- Risk Communication



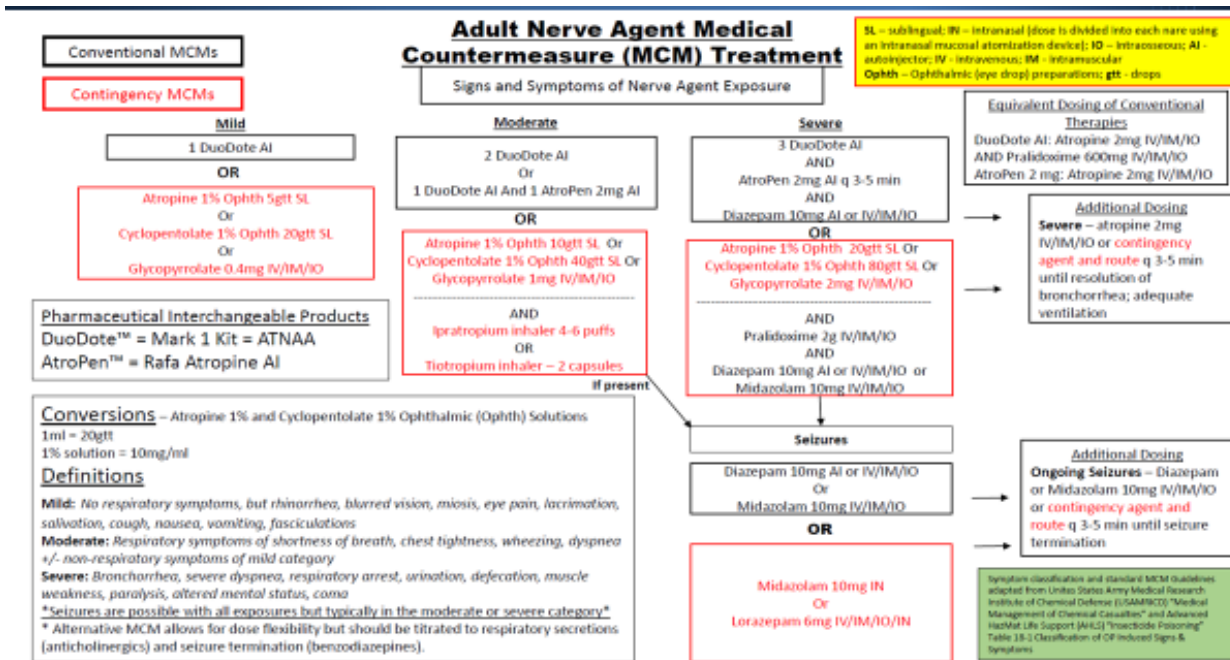
Potential Drug Shortage Situation

Challenges

- Forecasting needs
 - What and how much do we have?
 - What do we need?
- Finding alternatives on the fly
- What else might be effective instead of the recommended treatment?
- Administration
 - Adapting protocols
 - Just in time training



Contingency Medical Countermeasures for Treating Nerve Agent Poisoning



Seizures

Diazepam 10mg AI or IV/IM/IO
Or
Midazolam 10mg IV/IM/IO

OR

Midazolam 10mg IN
Or
Lorazepam 6mg IV/IM/IO/IN

Additional Dosing Severe – atropine 2mg IV/IM/IO or contingency agent and route q 3-5 min until resolution of bronchospasm; adequate ventilation

Additional Dosing Ongoing Seizures – Diazepam or Midazolam 10mg IV/IM/IO or contingency agent and route q 3-5 min until seizure termination

Signs classification and standard MCM guidelines adapted from United States Army Medical Research Institute of Chemical Defense (USAMRIID), "Medical Management of Chemical Casualties" and Advanced HazMat Life Support (AMLS) "Insecticide Poisoning" Table 18.1 Classification of OP Induced Signs & Symptoms

Conversions – Atropine 1% and Cyclopentolate 1% Ophthalmic (Ophth) Solutions
1ml = 20gtt
1% solution = 10mg/ml

Definitions
Mild: No respiratory symptoms, but rhinorrhea, blurred vision, miosis, eye pain, lacrimation, salivation, cough, nausea, vomiting, fasciculations
Moderate: Respiratory symptoms of shortness of breath, chest tightness, wheezing, dyspnea +/- non-respiratory symptoms of mild category
Severe: Bronchospasm, severe dyspnea, respiratory arrest, urination, defecation, muscle weakness, paralysis, altered mental status, coma
Seizures are possible with all exposures but typically in the moderate or severe category.
** Alternative MCM allows for dose flexibility but should be titrated to respiratory secretions (anticholinergics) and seizure termination (benzodiazepines).*

https://chemm.nlm.nih.gov/Contingency-NA-MCM-Guidance_rev-20-Dec-2018.pdf



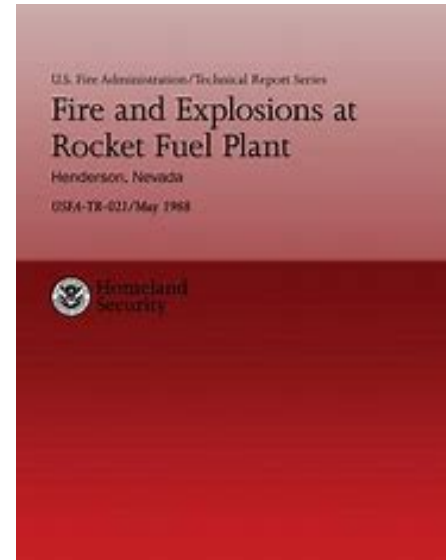
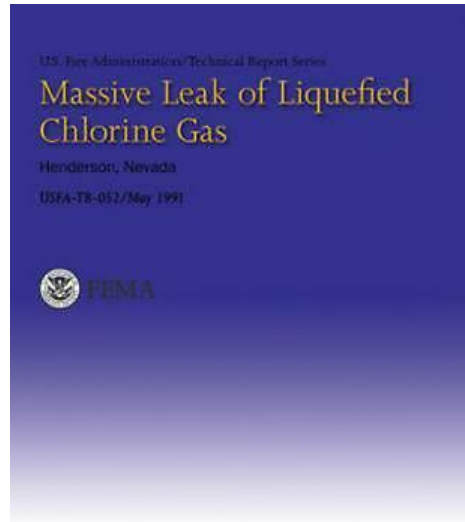
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Bruce Evans, MPA, NRP, SPO, CFO
Upper Pine River Fire (CO)



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Experience from the Field



Experience Lessons

- Listen to plant experts
- Understand chemistry
- Question deviations of protocol or hazardous material operating site practices
- Gather everything for after action reports



Train, Train, Train

- Get in the suits and use the meters
- Conduct research on the fly
- Use tracer materials to verify decontamination
- Get toxicology education
- Learn who to trust in the command structure
- Abide by crew resource management principles; speak up respectfully
- Take advantage of federally supported training



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Stephen Grant, MD
Lexington Medical Center (SC)



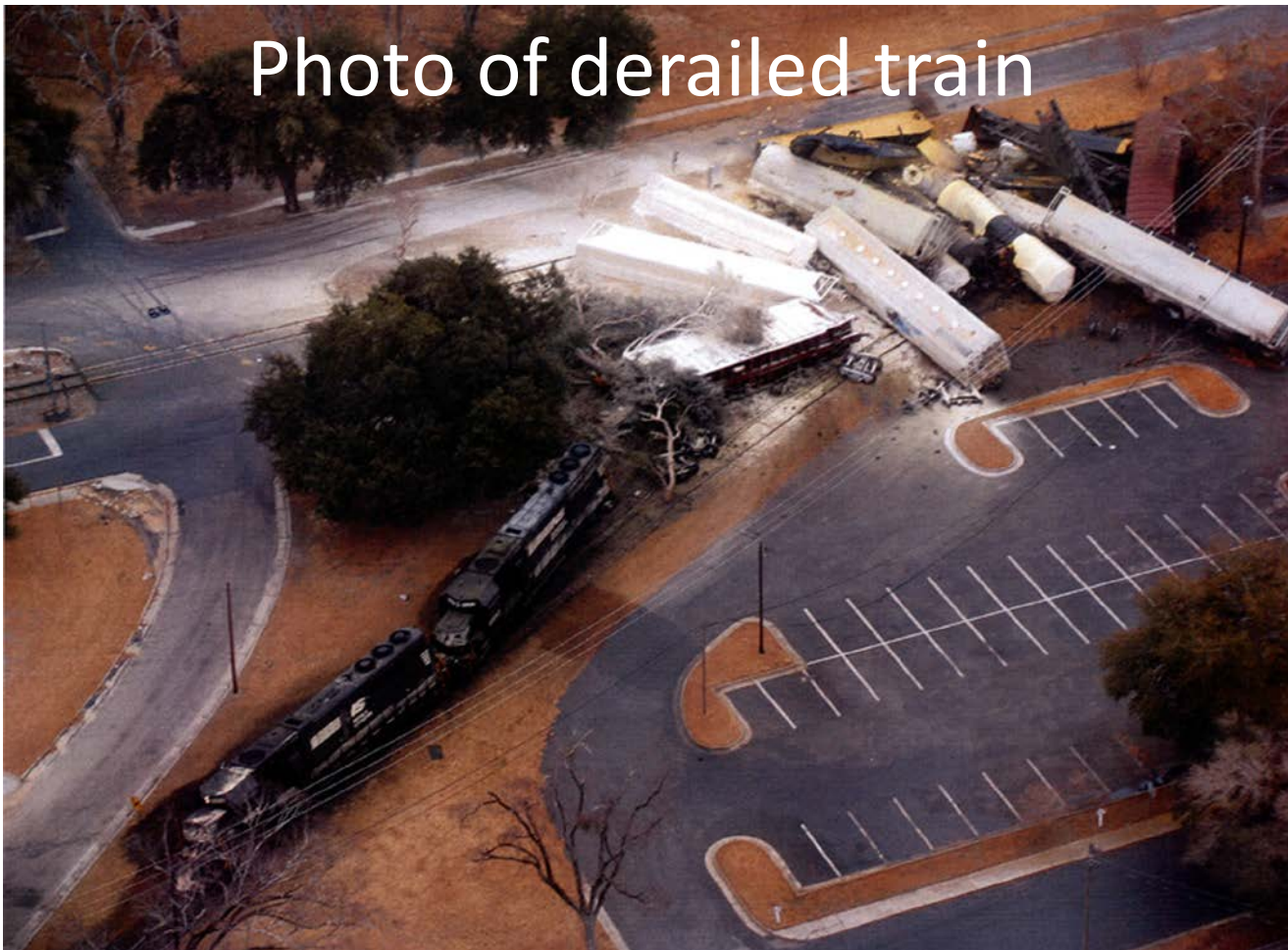
Graniteville Chlorine Disaster: Jan 6, 2005

- Norfolk Southern Train 192
- 42 Car, 3 Engine, 2 Crew Members
- Went off main line onto siding @ 47 MPH
 - Crashed into 3 car, 1 Engine Train P22
 - Parked for night - Mandatory rest
- Manual switch not reset to main line

16 of 42 Cars Derailed at 2:42 am

- Automatic brake was deployed
- After collision, main line train bounced backwards
 - No traumatic injuries noted to crew
- Derailment occurred at switch
- All 3 chlorine tankers derailed
 - One chlorine tanker ruptured

Photo of derailed train



Estimated Extent of Chlorine Cloud

- 2500 feet to North
- 1000 feet to East, West and South
- Release of gas caused cooling of tanker
 - Liquefied remaining Cl₂
 - Limited further release
- Estimated 46 of 90 tons released
- RR and plant located along canal in valley

Rapid Evacuation

- 500 workers at Woodhull Plant
- Managers/workers huddled at back of plant
- Workers had to shut down boilers
- Noxiousness: rapid evacuation decision
 - **Came by POV to hospital**
- Five of these employees among dead

Aiken Regional at Time of Disaster

- 14 bed Emergency Department (5 E.C.)
- ICU beds available: 1
- Major remodeling of ED underway
- Staff
 - 1 ED Physician
 - 5 Nurses, 2 Techs, 2 RTs in hospital
 - 1 X-ray tech

3 AM: Mass Confusion in ED

- EMS dispatch 2:54 alerted ED of wreck
- Dozens of patients arrived in minutes
- Strong “Swimming Pool” smell on patients
- Trauma Alert called
- Triage Nurse overwhelmed

Triaging Initial Wave

- Oxygen and Pulse Ox's brought to triage
- Universal complaints were
 - Burning eyes and throat
 - Chest discomfort
 - SOB
- Low pO₂ = ED Admit

Public Safety Decisions

- Police arrived at hospital: crowd control
- Deputy asked “What can I do”
- Dr. Yeh: Take non-critical patients away
 - Transported to campus across street
 - Decontaminated and re-triaged
 - Many sent to other area hospitals

Public Safety at Scene

- Area quarantined by about 3 AM
- Command Center established 3 AM
 - Subsequently pulled back from site
- Call for all EMS units/ bring PPE
- Decontamination center across street
- Setup by 3:35 AM across from hospital
- Two additional decontamination centers

Distribution of Patients : Area Hospitals

	Treated	Admits	ICU	Died
ARMC	112	24	4	1
UH	123/93	20	4	0
MCG	32	14	1	0
St. Joe's	9	3	0	0
Doctor's	30	12	3	0
Lexington	5	5	1	0

Secondary Assessment of Patients

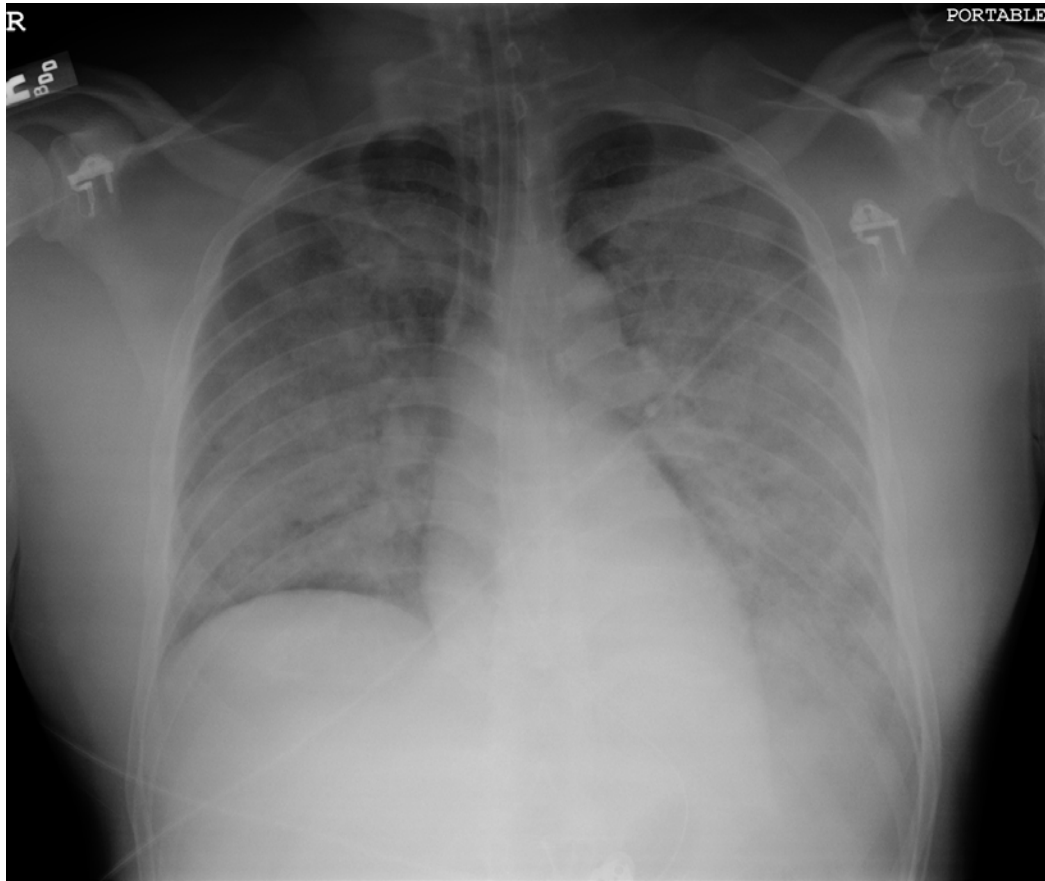
- H & P
- Portable CXR - Hard copy stayed with patient
- ABG: first 4-5 ruled out Meth-HGB
- Monitors especially Pulse Ox
- Registration overwhelmed: Paper Charts
 - Many patients seen, not registered

Chlorine Gas

- Wide industrial use
 - H₂O Purification, Bleaching Paper, PVC
- Transported by rail, truck
- Much heavier than air or water
- Yellow-greenish gas
 - Permissible level 1 PPM (OSHA)
 - Detectable 0.2 -3.5 PPM
 - Rapidly fatal 1000 ppm

Chlorine: Acute Toxicity

- Burning eyes, nose, throat, and cough
- CP, SOB, wheezing
- Pulmonary Edema:
 - Active Arterial and Capillary Hyperemia
 - Plasma Exudate fills Aveoli



Treatment of Cl₂

- Decontamination
- Oxygen
- Bronchodilators
- Mechanical Ventilation
- Inhaled BiCarb

Surge Capacity: Hospital

- Cancel all day and elective surgery
- Freed up massive resources
 - Day surgery intake/recovery 20 beds
 - Recovery room became 2nd ICU Area
- Large day staff due in by 6:30 AM
 - Day surgery – Treatment for non-acute
 - Express care – Secondary triage

Top Ten Take Home Points

- 10- Every mass disaster is unique
- 9- Have a talented ED rep at the EOC
- 8- Quickly establish perimeters/security at scene and at ED and hospital
- 7- Decontamination area away from triage
- 6- Hospital must *Clear the Decks*

Top Ten Take Home Points

- 5- Main ED: staff it with ED personnel
- 4- Quickly expand treatment areas
- 3- Stick to your knitting
- 2- Charts: paper is quickly transferable
- 1- Design your disaster response to fail intelligently:
 - Paper charts
 - Backup power



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Moderator Roundtable
John Hick, MD



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Question & Answer



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