

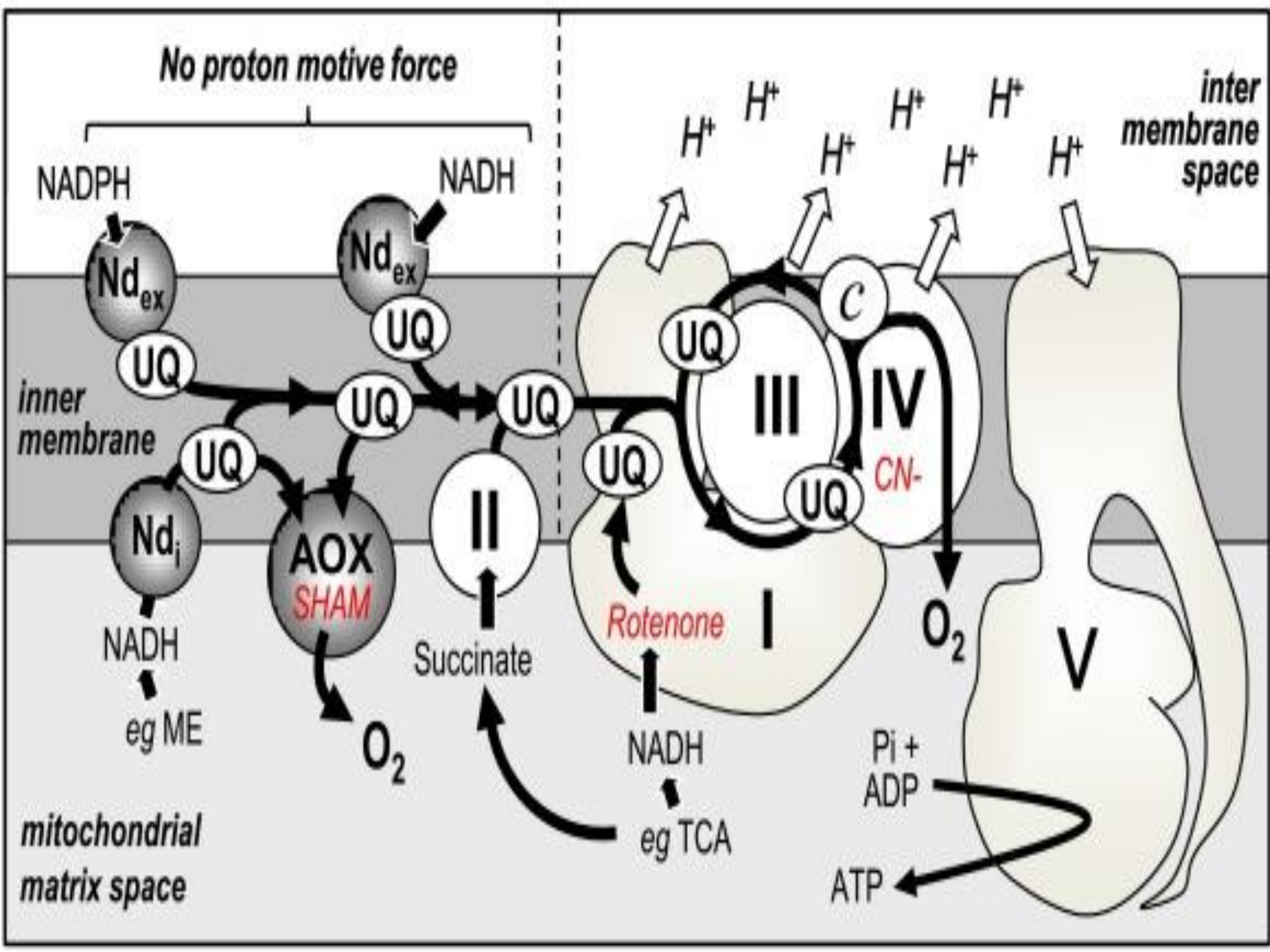
The Done-Got Poisoned Blues: what do we need to remember about cyanide

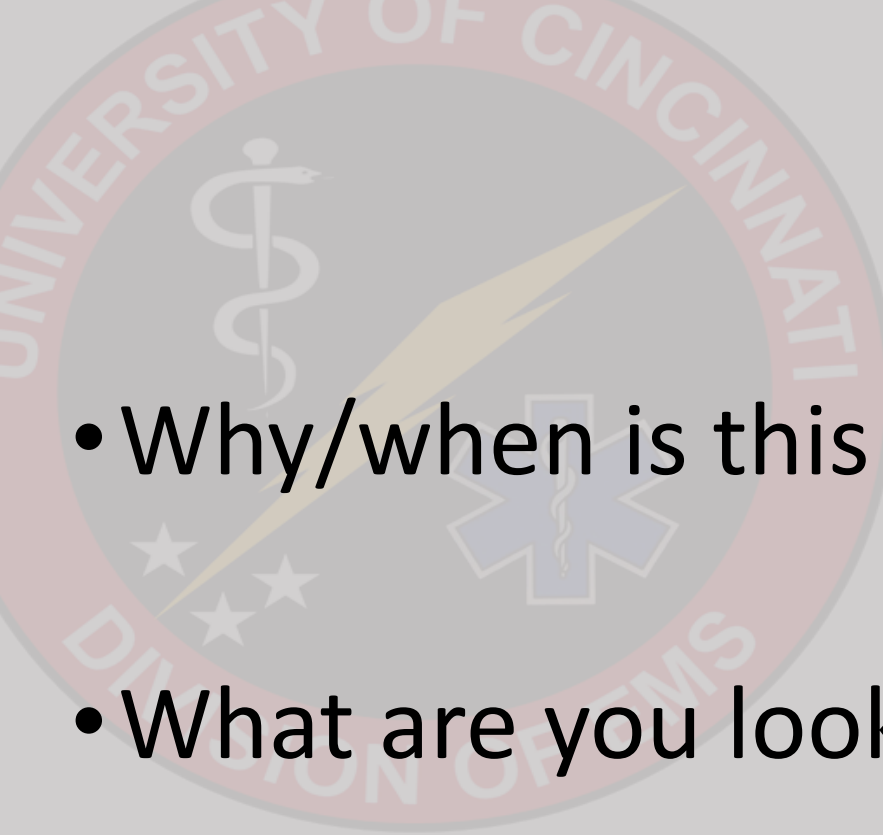


Dustin J Calhoun, MD FAEMS
Medical Director
Cincinnati Fire Department
Associate Professor
University of Cincinnati



No proton motive force



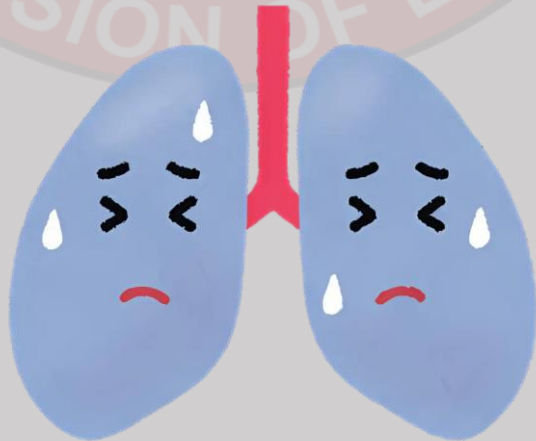
- 
- Why/when is this an issue?
 - What are you looking for?
 - What should you be doing?





WHY?

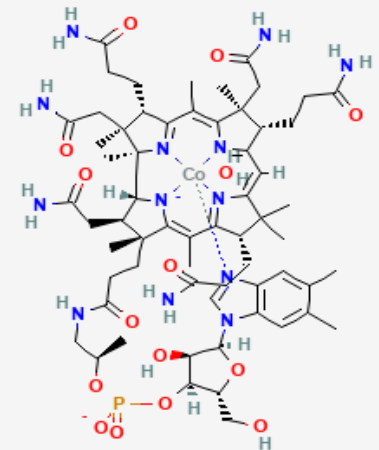
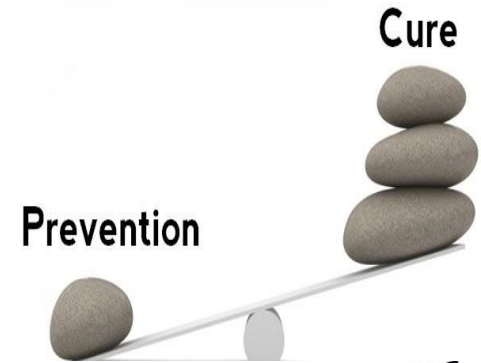




- Weak/dizzy
- Dyspnea
- Diaphoresis
- Headache
- AMS
- Dysrhythmia
- Chest pain
- Seizure/tremor
- Cardiac arrest

What to do?

- ***Prevention***
 - PPE
 - Understand timeline
- ***Recognition***
 - Broad range of symptoms
 - Understand timeline
- ***Treatment***
 - Antidote availability
 - Transport timing



TIPS & TRICKS

- Drip set

- Pedi dosing

Cyanokit® (Hydroxocobalamin) PEDIATRIC Dosing and Administration

1. Reconstitute and mix 5-gram Cyanokit® vial with 200mL normal saline as directed on the packaging
2. Connect included tubing to vial. If needed, attach 3-way stop-cock to IV/IO
3. Draw up appropriate volume based on patient age in syringe attached to stop-cock (may require multiple syringes to administer dose)
4. Administer dose via IV/IO* over 15 minutes

*No other medications can be administered through this line

Age-Based Dosing of Cyanokit®

Age	Less than 3 years	3-7 years	7 years or older
Dose (gram)	1 gram	2 grams	5 grams
Volume (mL)	40 mL	80 mL	200 mL







Hazardous Judgements

*What Kind of Decision-Making Should
We Anticipate in Haz-Mat Response?*

James Augustine, MD

Medical Director, Intl Association of Fire Chiefs

Fire EMS Medical Director

Clinical Professor, Wright State Univ DEM



Contamination Prep: One Big Cycle

50s, 60s	Nuclear War
70s	Trauma, Cardiac Arrest, Burn
80s	Hazardous Materials
90s	AIDs, Hepatitis (Bloodborne)
2000s	Terrorism, Airborne Illnesses
2010s	SARS, Ebola
2020s	COVID, Active Violence, Nuclear War

What is New?



A large plume of smoke rises over East Palestine, Ohio, after a controlled detonation of a portion of the derailed Norfolk Southern trains.

First on CNN: CDC team studying health impacts of Ohio train derailment fell ill during investigation



CIAC
Colorado Information
Analysis Center
Department of Public Safety

04 November 2023
23-25923

SITUATIONAL AWARENESS BULLETIN

(U//FOUO) Increase of Nitazene Analog, Protonitazene, Leading to Heightened Risk of Overdose

(U//FOUO) The Colorado Information Analysis Center (CIAC) has prepared this Situational Awareness Bulletin to provide information to law enforcement and first responders regarding the increase of a synthetic opioid, Protonitazene, and its potential impact on the State of Colorado.

(U//FOUO) Synthetic opioids, including the nitazene drug class, is among the fastest growing types of opioids detected in patients admitted into the emergency department with opioid overdose.² One of the many nitazene analogs that have emerged in the United States is protonitazene. Protonitazene is three times more potent than fentanyl and 100 times more potent than morphine. Protonitazene identification has increased recently in both toxicology and post-mortem lab samples, and is often present with other illicit drugs.³

(U) In recent years, several nitazenes have been detected in



an,



Strategic Issues

What would the Contaminated Pt ask us to do?

- Focus area is ***Contamination plus Injuries and Illnesses***
- Decon needs versus medical care needs
- Treatment and decon strategies seamless from field to ED
- Credible person to talk to the public?

Decon Patient Decisions

- **Based on**
- **Agent**
- **Environment**
- **Desired outcome**
 - As clean as possible
 - Completely decontaminated
- **Medical Condition**



**Eye
Spray**



**MC
A**



**Doused in
Alkali**

Priority Setting for Decon and Medical Care	Critical Ill, Trauma, Burn	Moderately Ill, Trauma, Burn	Extremity Trauma, Or Burn
Heavily Contaminated Highly Toxic	Balance	Decontaminate	Decontaminate
Heavily Contaminated Low Toxicity	Resuscitate	Balance	Balance
Low-level Contamination Highly toxic substance	Balance	Decontaminate	Decontaminate
Low-level Contamination Low Toxicity	Resuscitate	Resuscitate	Balance
Chemical Exposure to the eyes only	Decontaminate eyes immediately/thoroughly		

Decontamination Management Priorities



- Strip the victim! (cutting or peeling off clothes, don't shake)
- Cover any open wounds (abrasions, lacerations, open burns) with plastic wrap or a glove to prevent secondary contamination
- Isolate airway from contaminated body oxygen mask at 10 LPM

Decontamination Management Priorities



- Warm water is much preferred to prevent rapid cooling of the patient
- After initial decon, cocoon victim to prevent secondary contamination and cooling
- Irrigate eyes with any sterile solution, preferably one not contain glucose
- **Save patient's wallet, ID, etc. in a plastic bag separate from clothing**



CBRNE: Radiation vs. Nuclear

- Radiation = exposed to waves of radioactivity. Not a hazard to rescuer....
Rescuer hazard to patient!
- Nuclear = exposed to material, and may be contaminated
- Strip all clothes, wet decontaminate

Biologic Agents worth Planning For

- COVID
- Ebola, Marburg
- H5N1 and similar
- Anthrax
- Botulism Toxin
- Meningitis
- MRSA
- Scabies
- Measles, Mumps, Chickenpox
- Bed Bugs, Lice



Decisionmaking in PPE

Nichole Hansen, Lee County EMS

First Responder PPE Chart


	1	2	3	4	3	4
Organism Based	Standard Precautions	Contact Precautions	Droplet Precautions	Droplet + Contact Precautions	Airborne Precautions	Airborne + Contact Precautions
Syndromic Precautions	HIV, AIDS, Cellulitis	C.Difficile, CPO, MRSA, lice, scabies, VRE, RSV, norovirus	N.Meningitis, mumps, pertussis	Influenza, Invasive Group A, Streptococcus	Tuberculosis (TB), measles	Shingles, Chickenpox, Monkeypox
Responder PPE	Fever, night sweats, swollen lymph nodes, swollen skin, & inflamed w/ pain	Fever, cough, wheezing, draining wound, diarrhea*, vomiting, infestation	Stiff neck, fever, headache, AMS, whooping cough, vomiting	Malaise, acute cough, sore throat, runny nose, fever, toxic shock syndrome	Fever, weight loss, cough, night sweats, skin rash	Fever headache, rash, disseminated rash, rash similar to pimples or blisters
PPE Reminders	Use eye protection for airway procedures and gown for splash and liquid procedures	Use eye protection for airway procedures	Use a gown for splash and liquid procedures	Use eye protection for airway procedures + gown for splash and liquid procedures	Use eye protection for airway procedures + gown for splash and liquid procedures	Use eye protection for airway procedures + gown for splash and liquid procedures
Patient PPE (Mask) Needed ?	X	X / ✓ RSV	✓	✓	✓	✓

*Use an impervious patient occlusion or coverall suit to contain infectious bodily fluids, if possible

Definitions:

AIDS = Acquired Immunodeficiency Syndrome
CPO = Carbapenemase-Producing Organisms
HIV = Human Immunodeficiency Virus

MRSA = Methicillin-Resistant Staphylococcus Aureus
RSV = Respiratory Syncytial Virus
VRE = Vancomycin-Resistant Enterococci



What would the Hospital ask us?

- There should be designated EDs for infected or contaminated patients
- We should always get as few EDs “dirty” as possible
- What are communication priorities to the receiving ED?
 - Notify early
 - Don't enter ED until it is prepared

Fire EMS All Hazards Teams

JHAT = Joint Hazard Assessment Team

Rapid detection equipment for both chemical and biological agents

Radiation Detection

Explosive Detection

Dry Decontamination process adopted





What would the Patient want from Customer Service?

Don't make me wait

Save my life and limbs

Don't hurt me anymore. Don't make me cold

Explain what you are doing

Get me through the decontamination quickly and into "regular" care

Find out what contaminated me, how much and what is the risk

Explain to me what, if anything, I need to do next

Talk to my boss

Confidentiality, please



What would the ED Staff want?

Protect our worksite

This is infrequent and different than normal process –
please make it as easy as possible


Protect me from harm

Allow me to move the patient quickly to “regular” care

Simplify all my paperwork

Have someone who knows what they are doing clean up
the mess

Don't make me talk to more people than I have to,
including the media.



Industry = The Business of your Community ***What do they Want?***

I am really at risk – take good care of the patient who is my employee

Use me for information on products handled in the workplace

Tell me what needs to happen, if anything

Let me know what you did

Please make it cost-effective, and bill me in a fair and expedient manner.
The interaction with the regulatory process is facilitated by me receiving
and paying the bill

Give me immediate documentation and make follow-up documentation
available.

REHABBING REHAB: *TWO THOUSAND AND TWENTY FOUR WAYS TO MANAGE FIRE-GROUND RESCUE*

Robert B Dunne, MD FACEP, FAEMS

Medical Director

Detroit Fire Department

Detroit East Medical Control Authority

EAGLES 2023



QUESTIONS

- Why are fires killing people?
- Why is fireground resuscitation different?
- How can we save more people?
- How can we best protect our firefighters?
- Not just for most severe
- Need good rehab program with monitoring



EVOLUTION OF RESIDENTIAL FIRE DYNAMICS

Transition from legacy to modern materials changes fire dynamics and fire smoke¹

Natural (legacy)

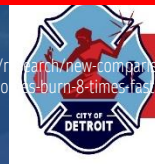


Synthetic (modern)



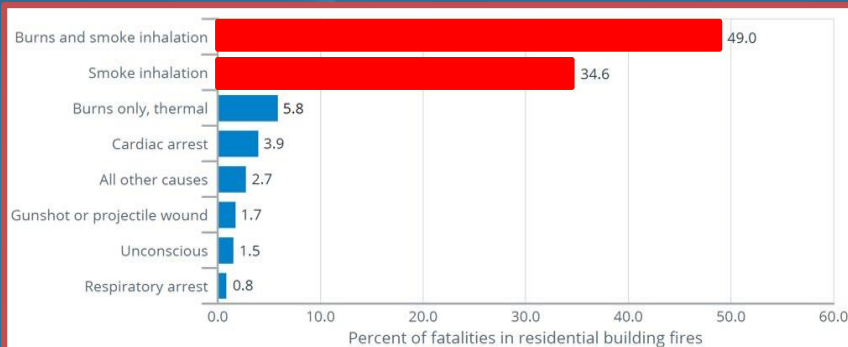
200x more smoke and 8x faster burning rate than 50 years ago²

¹ New comparison of natural and synthetic home furnishings. (2020, September 30). UL's FSRI - Fire Safety Research Institute. <https://fsri.org/research/new-comparison-natural-and-synthetic-home-furnishings>. ² Modern homes burn 8 times faster than 50 years ago. (2013, September 13). CBC. <https://www.cbc.ca/news/canada/windsor/modern-homes-burn-8-times-faster-than-50-years-ago-1.1700063>

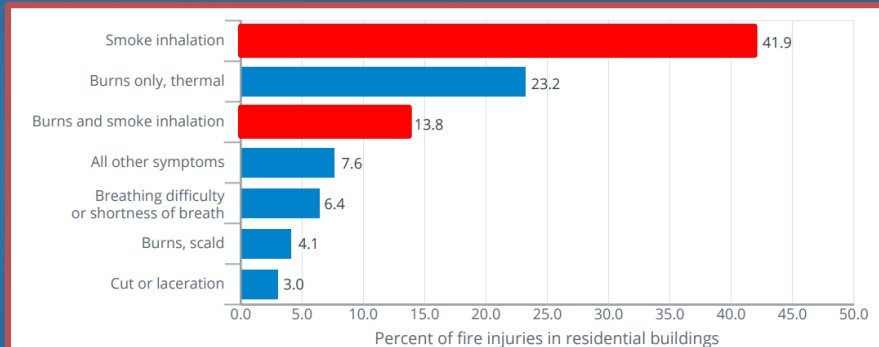


CIVILIAN FIRE FATALITIES & INJURIES IN RESIDENTIAL BUILDINGS BY PRIMARY SYMPTOM (2017-2019)¹

Fatalities



Injuries



The most common cause of death in fires is the *inhalation of noxious gases rather than thermal injury*²

¹ (n.d.). U.S. Fire Administration. <https://www.usfa.fema.gov/downloads/pdf/statistics/v21i4.pdf> ² Jones, M., Mullen, M., & Dougherty, J. (1987). Toxic smoke inhalation: Cyanide poisoning in fire victims. *The American Journal of Emergency Medicine*, 5(4), 311-321. [https://doi.org/10.1016/0736-5931\(87\)90360-3](https://doi.org/10.1016/0736-5931(87)90360-3)

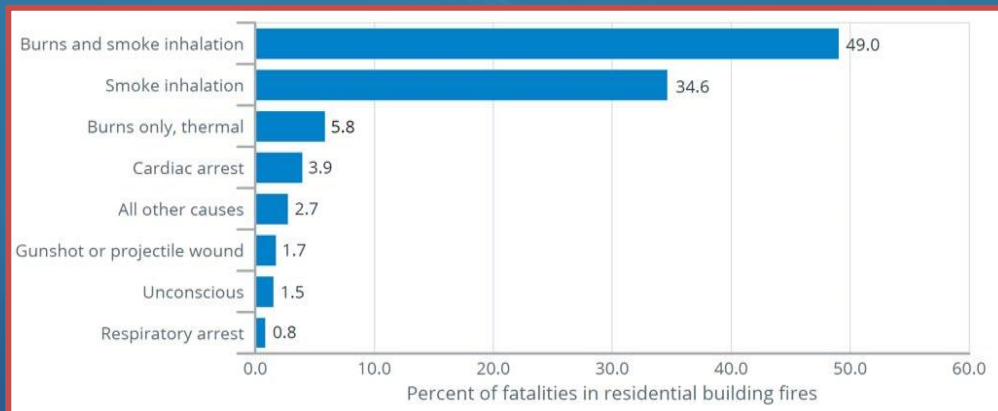


HAZARDS (NO ANTIDOTE YET)



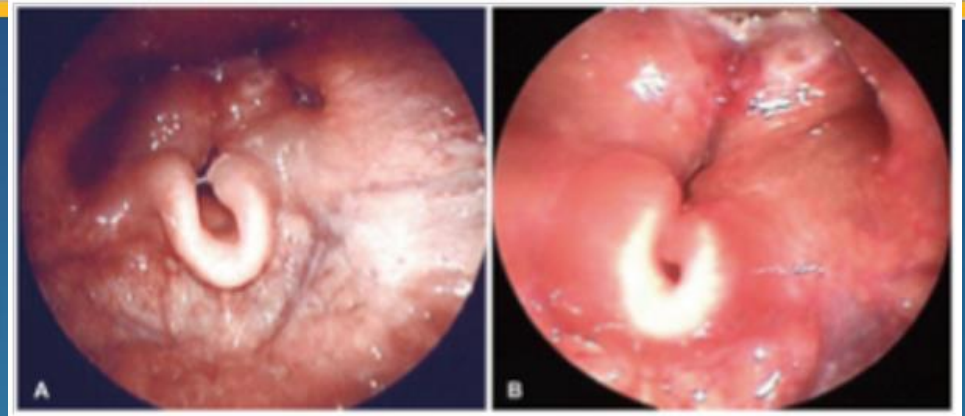
HAZARDS – WHAT CAN WE DO TO IMPROVE OUTCOMES?

- Airway Burns
- Carbon Monoxide (CO)
- Cyanide (CN)



AIRWAY

- Expect difficulty
- Time is not your friend
- Bougie, Video if available, prep for surgical airway
- Goal is cuffed tube in Trachea



CARBON MONOXIDE MONITORING

- In the studies conducted to submit the device for FDA clearance, the CO-oximeter has exhibited accurate readings for COHb values between 0 and 40%.
- Do this in Rehab



Cone DC, MacMillan DS, Van Gelder C, et al. Noninvasive fireground assessment of carboxyhemoglobin levels in firefighters. *Prehospital Emergency Care*. 2005;9:8—13.



THE TOXIC TWINS- PATHOPHYSIOLOGY

Smoke Inhalation

Hydrogen Cyanide (CN)

Produced from incomplete combustion of *nitrogen-containing materials*

Difficult to detect



Neurotoxicity



Inhibition of Cellular Respiration



Carbon Monoxide (CO)

Produced from incomplete combustion of hydrocarbons or fuels

Easy to detect



Carboxyhemoglobin formation



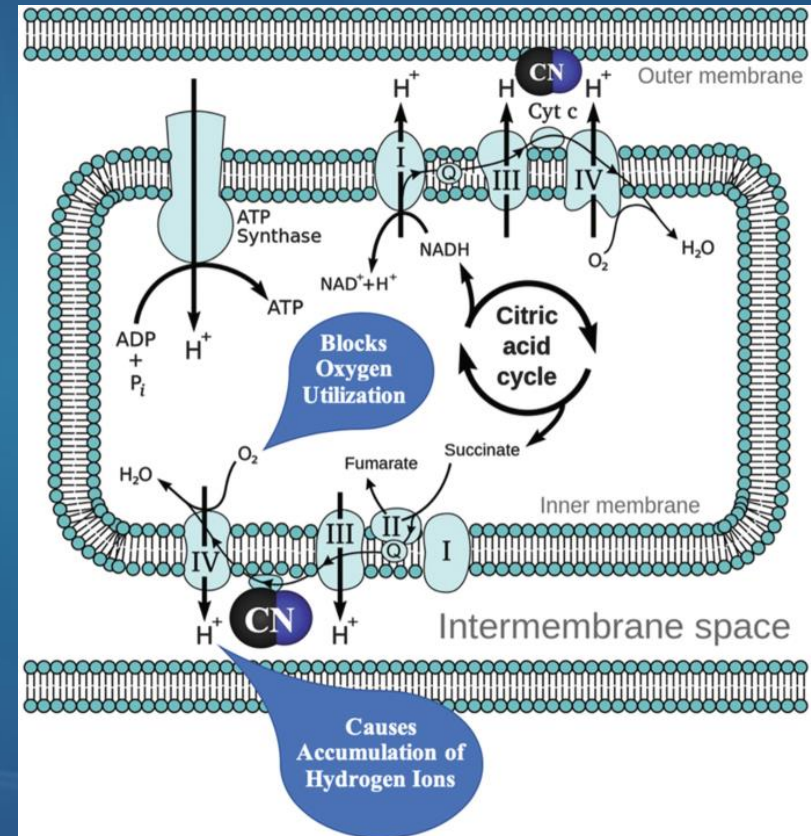
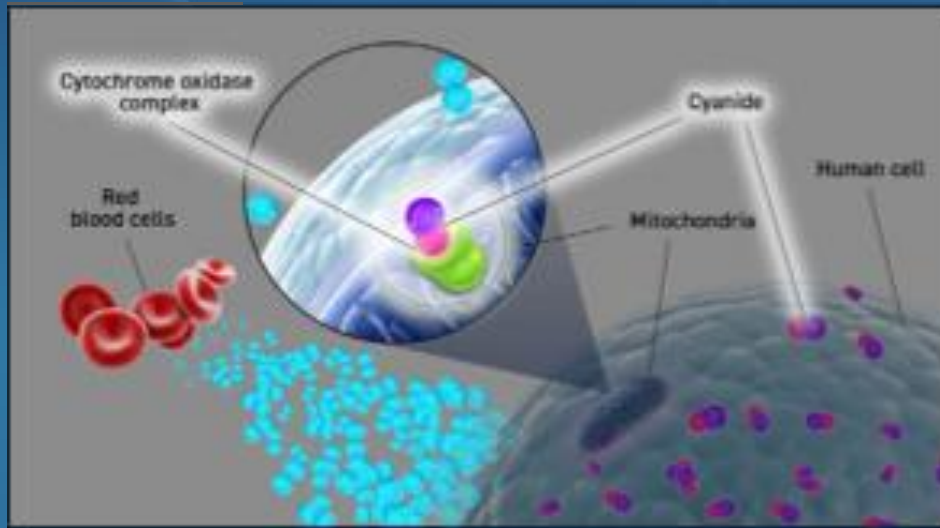
Inhibition of Cellular Respiration



1. Hoffman, R. S., Nelson, L. S., Goldfrank, L. R., Howland, M. A., Lewin, N. A., & Smith, S. W. (2019). *Goldfrank's toxicologic emergencies* (11th ed.). McGraw-Hill Education. 2. Rose, J. J., Xu, Q., Wang, L., & Gladwin, M. T. (2015). 2. Shining a light on carbon monoxide poisoning. *American Journal of Respiratory and Critical Care Medicine*, 192(1), 1145-1147. <https://doi.org/10.1164/rccm.201508-1679ed>

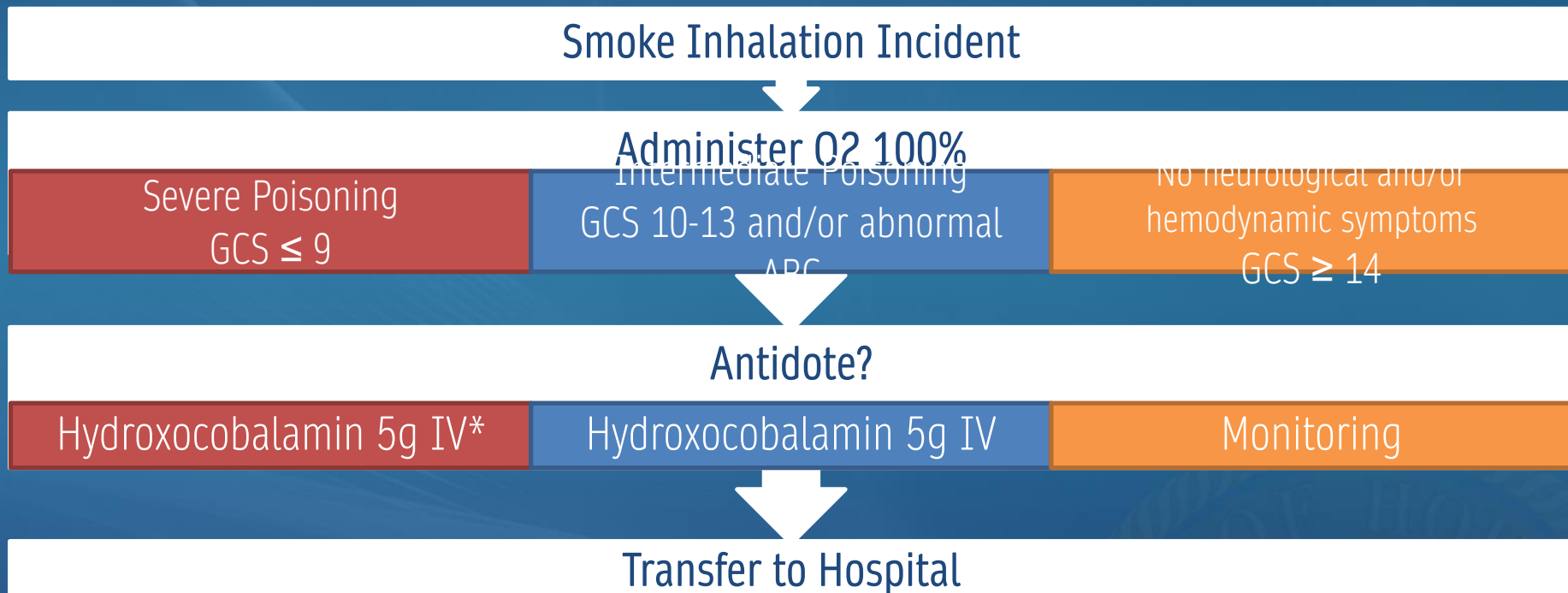


WHY IS CYANIDE BAD?



THE TOXIC TWINS- MANAGEMENT

Cyanide Poisoning by fire smoke inhalation: A European Expert Consensus Cyanide Poisoning by Fire Smoke Inhalation Prehospital Algorithm



GCS= Glasgow Coma Scale, ABC= airway, breathing, circulation, IV= intravenous, g= gram, O2= oxygen

***If cardiac arrest, administer second dose hydroxocobalamin IV**

Adapted from: Anseeuw, K., Delvaux, N., Burillo-Putze, G., De Iaco, F., Geldner, G., Holmström, P. et al. (2013). Cyanide poisoning by fire smoke inhalation. *European Journal of Emergency Medicine*, 28(1), 1-9. <https://doi.org/10.1097/MEJ.0b013e31826357170b>



COMPREHENSIVE REHAB

- Protocolized /Dedicated team
- Equipment
- Monitoring at all fire scenes
- Vitals, NI CO, watch for MS changes
- Record Keeping
- Heat/Cold Management

1.0 Purpose

To prevent the physical and/or mental deterioration of all Detroit Fire Department Emergency Services personnel that are operating at the scene of an emergency or training exercise. To also ensure that medical monitoring is occurring at an incident after certain criteria are met.

2.0 SCOPE

This guideline applies to all emergency operations where strenuous physical or mental activity or exposure to extreme heat or cold exists. This guideline should commence whenever emergency operations or training exercises pose the risk of members exceeding a safe level of physical or mental endurance. This document is intended to apply to all firefighters, medics, and special operations teams in the City of Detroit. For

Guidelines for RELEASING Personnel from Rehabilitation for Additional Assignments (After 20 Minutes in Rehab)		Guidelines for TRANSPORTATION of Personnel to Hospital (After 35 Minutes in Rehab or Paramedic Discretion)	
<ul style="list-style-type: none"> ➤ Gear should be removed except in cold weather. ➤ Rehydration with at least 16-32 oz. of Water ➤ Minimum of 20 minutes in Rehab 		<ul style="list-style-type: none"> ➤ ANY Emergency Condition SHALL be treated and Transported As-Soon-As-Possible! 	
VITAL SIGNS		VITAL SIGNS	
<ul style="list-style-type: none"> ➤ Systolic B/P less than 160 ➤ Diastolic B/P less than 100 ➤ Heart Rate less than 110 ➤ Oral Temperature less than 100.6° F ➤ <u>Any Personnel who exceed these limits must stay in Rehab an additional 15 Minutes and be reevaluated. Personnel may be transported at the discretion of the Paramedic.</u> 		<ul style="list-style-type: none"> ➤ Systolic B/P greater than 200 ➤ Diastolic B/P greater than 130 ➤ Diastolic B/P greater than 110 and symptomatic ➤ Diastolic B/P less than 110 and symptomatic ➤ Heart rate above 140 or less than 60 with hypotension ➤ Oral temperature greater than 100.6° F ➤ Symptoms of CO Exposure. (Headache, nausea, vomiting, Δ LOC) w/ elevated CO Level. 	
General Considerations		Procedure	
<ul style="list-style-type: none"> ➤ Mentally Prepared to return ➤ Oriented ➤ No Critical Incident Stress Symptoms ➤ Turnout Gear in Good Condition ➤ SCBA Refilled / Checked ➤ Entire Crew Prepared and Ready 		<ul style="list-style-type: none"> ➤ Crew is considered to be Out-of-Service until manpower is evaluated by IC/ISO ➤ Notification of the FF's immediate Supervisor by the Rehab Officer ➤ Treat / Transport per Pre-Hospital Protocols or Medical Control Direction ➤ Notify DFD Medical Director Via Central 	
Release to Scene through Staging			
<ul style="list-style-type: none"> ➤ Return Accountability Tag to Company Officer 			

SIDE WITH SAFETY!!! THE FIREFIGHTER'S FAMILY IS COUNTING ON YOU!



IDENTIFY, ANALYZE, DEVELOP, IMPLEMENT

- Cuffed Tube in Trachea (ASAP)
- Monitor CO
- 100% Oxygen
- CN Antidote (Hydroxocobalamin)
 - ▶ Need on Front line
 - ▶ Eagle Survey – Many large systems have
 - (but where???)
- Review your data

