



Unit 13: Hazards and Risk Mitigation

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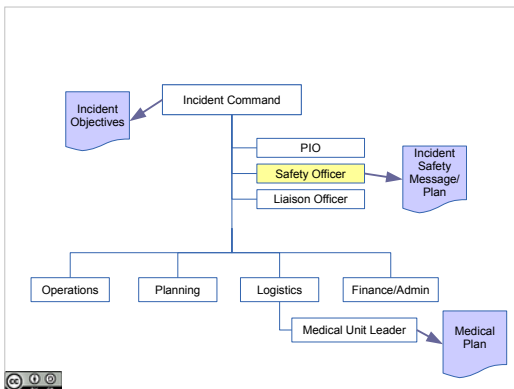
Hazards and Risk Mitigation

- Goal: Everyone goes home safe.
- Objective: Ensure the safety of all responders and the general public throughout the entire duration of the incident.
- Follow a Risk Management Process

A general goal for any incident is that everyone goes home safe.

Express as smart objective (manage by objectives): Ensure the safety of all responders and the general public throughout the entire duration of the incident.

Then follow a formal process for operational risk management. We'll talk about the Cyclical Risk Management Process here.



ICS embeds several functions and documents to support safety and risk management.

Safety officer is responsible for standing back, observing and assessing the safety of the operation, and for formulating a safety message and plan for hazard mitigation.

Logistics embeds a medical unit, to serve the medical needs of the responders to the incident, the medical unit formulates a medical plan of resources and facilities available for the care of responders – entirely separate from medical response to the incident embedded in operations.



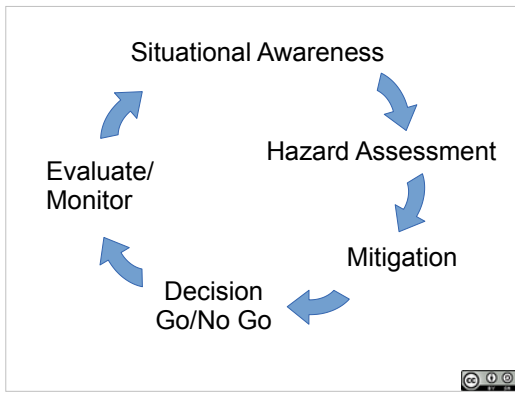
Everyone needs to be concerned with safety.

Safety officer is specifically called out as a separate command function to counteract tunnel vision on the response to the incident.

Incident response is not without risk.

Safety message/plan is a statement about risk mitigation.

Image © 2012 AttributionShare Alike Some rights reserved by US Forest Service Gilla National Forest



Here's a way of thinking about managing risk:
Cyclical Risk Management Process:

Starts with situational awareness.
 Then assess the hazards.
 Then determine mitigation measures.
 Then make a Go/No Go decision. Weigh the risks after mitigation and the benefits.
 Then evaluate and monitor.
 And back to situational awareness – is the situation changing?

Continually update and revise your image of the mission.

This model is for **everyone** in an incident, not just the safety officer. Maintain situational awareness and analyze the situation.

Operational Risk Management

- 1) Accept No Unnecessary Risk
- 2) Accept Necessary Risk When Benefits Outweigh Costs
- 3) Make Risk Decisions at the Appropriate Level
- 4) Integrate Operational Risk Management into Operations and Planning at All Levels

A number of federal agencies involved in SAR have adopted an Operational Risk Management approach.

This includes asking if risks are necessary, and performing a risk benefit analysis.

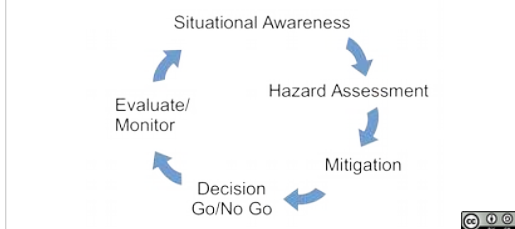
That's sometimes expressed as: Risk a little to save a little, risk a lot to save a lot.

Then there's what we are doing here – thinking about risk management at all levels, including the lowest level responders in the field.

With that goes having the right people in the ICS structure make risk management decisions.

Talk it through

- Out loud
- Make Risk Decisions at the Appropriate Level

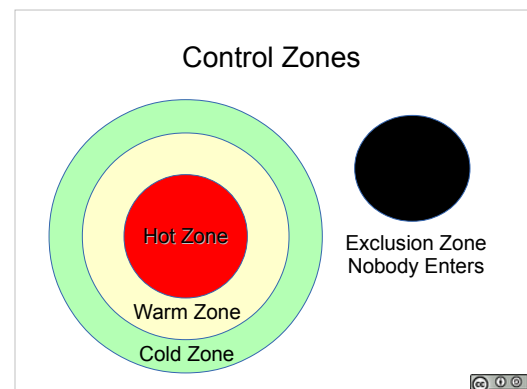


Talk the situation through out loud (even if you are alone – this slows down your brain and helps you think through the situation more clearly).

Don't be afraid to go up the chain of command in assessing risk.

It is always appropriate to raise safety concerns up the chain of command. Site Safety Officer, IC, Safety Officer could all be appropriate levels for assessment of hazards, consideration of mitigation measures, and a go/no go decision. That all depends, however, on you maintaining situational awareness, monitoring changing conditions, and communicating about hazards.

Control Zones



One tool for risk mitigation is Hot/Warm/Cold zones.

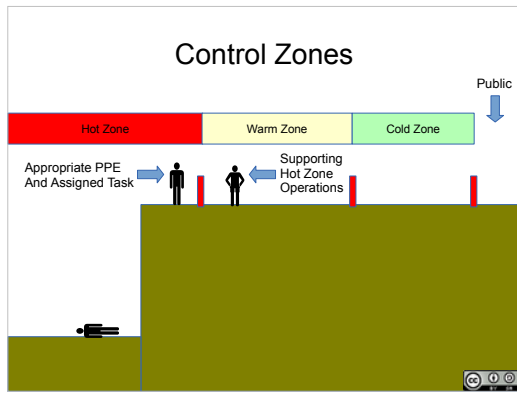
Cold Zone: ICP, Staging

Warm Zone: Support for entry into Hot Zone

Hot Zone: Only with PPE for specific assignment.

General public kept out of the cold zone.

Special control zone – exclusion zone, nobody is to enter.



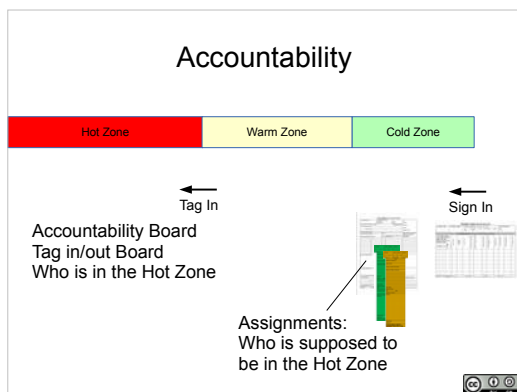
This course doesn't prepare you to operate in the hot zone, or to support operations from the warm zone.



Treat 10 feet from an edge as a hot zone.

Gravity is dangerous.

Who is in harness in this image?



Accountability mechanisms for the cold and warm zones include sign in and t-cards. T-cards can record who has an assignment in the hot zone.

Hot zone should have a separate accountability mechanism such as an accountability board recording who enters the hot zone when, and when they come out – a mechanism for identifying who is in the hot zone.



Some hazards are everyday hazards.

What is this? (poison ivy)

Contains urushiol, which causes contact dermatitis in sensitive individuals (most people).

Everyday Hazards & Mitigation

- Ticks: Recognition, insect repellent, light colored clothing, gaiters, tick checks.
- Poison ivy: Recognition, long pants, long sleeves, avoid sweaty thin clothing, barrier creams, poison ivy scrubs.
- Low branches: Wear safety glasses at night.
- Dehydration: Drink lots of water, carry lots of water.
- Sun exposure: Sunscreen, sunglasses, clothing.
- Uneven footing: Boots with ankle support.



Commonplace hazards, but can be very dangerous.

Some everyday hazards in New England listed, along with some potential means of mitigating these hazards.

Discuss.



What is this?

Poison ivy vine – with distinctive fuzzy rootlets.

Prevention measures: Dry, loosely woven fabrics, pre-exposure barrier creams, post-exposure (within 2 hours) solvent (Tecnu, Goop, Dishsoap), immediate washing with soap and water. Launder exposed clothing (urushiol contaminates and remains on clothing).

“Most ... rashes tend to occur through sweaty thin clothing”

“Proper identification and avoidance of *Toxicodendron* species is the best prevention”

[Quotes from: Gladman, 2006, *Toxicodendron* dermatitis. Wilderness and Emergency Medicine. 17:120-128]



What's this?

Poison sumac

Wetlands – shady swamps and bogs.

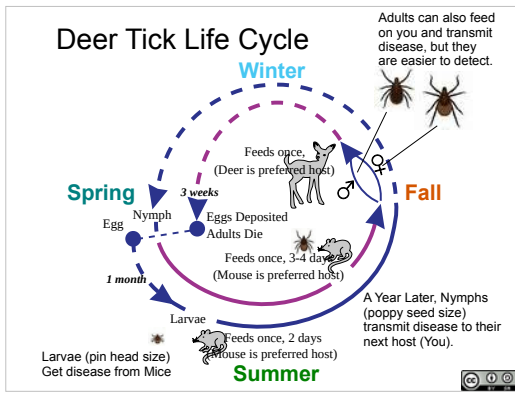
Compound leaves, leaflets connected by a **red** “stem” (rachis).

Poison Ivy and Poison Sumac are common in New England.



Deer Tick *Ixodes scapularis*, Adult Female

Carry and transmit disease organisms for: Multiple unpleasant tick borne illnesses: Lyme disease, Anaplasma, Ehrlichiosis, etc.

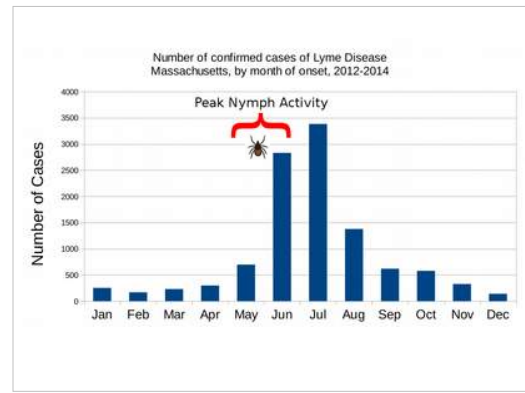


Deer ticks have 2 year life cycle. But, Ticks can be about at **any time of year**. Disease transmission peaks in Spring/Summer, but happens year round.

Larvae (pin head size) feed off small mammals, get infected with Lyme from the small mammals. Next stage, **Nymphs**, feed off of mice, birds, deer, dogs, foxes, humans, etc. Nymphs very high risk for transmission of lyme – small and hard to notice. Nymph: Think small black spot about the size of a poppy seed.

How do you mitigate this risk?

Tick Checks. Light colored clothing, permethrin treated clothing, insect repellent.



Here is surveillance data (for confirmed cases of Lyme disease, an underestimate of total cases) from Massachusetts.

You can catch Lyme disease any time of year. Ticks carrying Lyme disease (and other tick borne illnesses) can be active anytime of year.

Protect yourself year round.

Peak incidence in MA is June-July, following after the usual peak times for Nymph (poppy seed size, already fed on mice, carrying disease, hard to see) activity around May-June.

Emphasize the year-round message for everyone in April-May, before the peak nymph activity.



Sunburn.

Short term: Painful
Long term: Increased risk of skin cancer.

Mitigation: Clothing, sunblock.

Human Hazards

- Armed subject (hunter, despondent)
 - Volunteer SAR resources generally will not respond for searches for fugitives.
- Clandestine Drug Operation
- Hunters, Poachers
- Wells
- Mineshafts, Quarries
- Abandoned Buildings
- Domestic and Farm Animals

People and things made by people can pose risks to searchers.

Subjects may be armed (and might have an altered mental status).

Learn to recognize hazards and stay back/out.



What do we have here? Clandestine drug lab.
 What hazards?
 Are we too close?



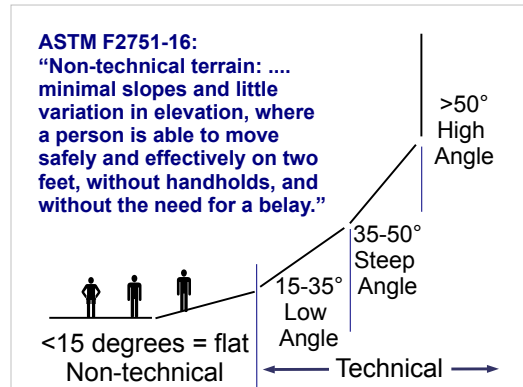
What do we have here?

What hazard can't we see here?

Bear cubs come with a mother bear.



What hazards exist in searching this terrain?
 Gravity.
 Gravity moving large rocks.
 Slip and break an ankle/leg/neck/head.
 Risks: Fall hazards, falling objects, trip hazards, unnecessary personnel.
 Can you move safely on two feet without handholds or a belay?



Definitions for high/low angle conditions vary:

NFPA: High Angle = Weight supported by rope system.
 Low Angle = Weight supported by ground.
 ASTM F2751-16: High Angle >50°, Low Angle 30°-50°
 Common (but slightly variable definition) we'll use here:
 Flat ground: 0-15 degrees (non-technical)
 Low angle: 15-35 degrees
 Steep angle: 35-50 degrees (most dangerous)
 High angle: 50-90 degrees

Quality of footing also factors in – poor footing, loose scree, etc, makes for more dangerous conditions.
 ASTM F2751-16 3.1.4 definition of non-technical terrain quoted.

Anything more that 15 degrees calls for support from technical rescue resources.

Technical Rescue Environments

- Technical Rescue resources may be needed in any phase of the search:
 - Locate
 - Access
 - Stabilize
 - Transport



We usually think of needing technical rescue for access, stabilization, and transport phases.

May need it for the locate phase as well.

Learn to recognize environments that should be searched by appropriate technical rescue resources.

Technical Rescue Environments

- Vertical Environment
- Confined Space
- Trench
- Structural Collapse
- Water (Still Water and Swift Water)
- Ice



All need specialized training and equipment.

Stay out.



You may get or seek out high angle rescue training.

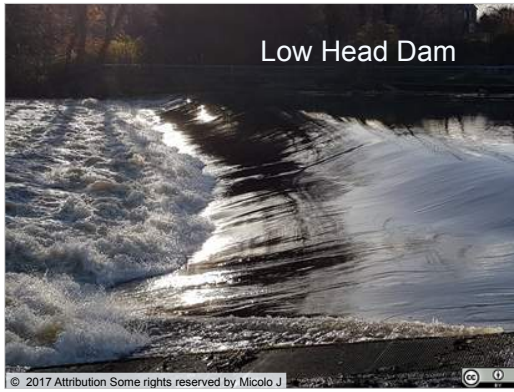
Water

- Drowning
- Hypothermia
- Currents
- Contaminated water
- Unsafe shorelines
- Electrocutation
- Confined spaces
- Low head dams, strainers.



Water has multiple hazards associated with it.

Discuss.



Drowning machine.

Very dangerous. Recirculating current at the base of the dam traps things there (including objects that can strike a person trapped in that current). Air bubbles in the water reduce buoyancy – someone wearing a lifejacket can sink in that foaming water.

Trapped in recirculating current, tumbling with logs, striking rocks on the bottom, unable to escape, unable to surface.



Here's a strainer. The branches can catch a body being carried downstream. Or, falling into the water next to it, an undertow can carry you down and trap you in the branches underwater. Likewise a risk for overturning a canoe.

Shorelines can also be dangerous – undercut banks and , slippery ground, can drop you in the water. There can be debris along the shoreline.

Potentially difficult places to search.

Confined Space

- Large enough and configured so that a person can enter and perform assigned work
- Limited or restricted means for entry and exit
- Not designed for continuous occupation.

Confined spaces are dangerous, and regulated.

Generally limited to fire service technical rescue resources. Significant training and equipment needed to enter.

Permit Confined Space

- Large enough and configured so that a person can enter and perform assigned work
- Limited or restricted means for entry and exit
- Not designed for continuous occupation.
- One of:
 - Contains or may contain a hazardous atmosphere
 - Contains material that may engulf a person
 - Internal configuration that could trap or asphyxiate a person
 - Contains any recognized serious safety hazard

Confined spaces may be outright deadly.

OSHA regulated confined spaces that require a permit for an employee to enter.

Extensive training, support, equipment, and documentation is needed for working in and around permit confined spaces.

Example confined spaces likely to be encountered in inland SAR

- Silos
- Sewers/Manholes
- Septic Tanks
- Underground utility vaults
- Ducts
- Pits and Ditches
- Machinery Housings



CC-BY Don O'Brien

You are likely to encounter hazardous confined spaces during searches including:

Agricultural confined spaces (silos, fruit storage), drains, septic tanks, areas frequented by urban explorers (abandoned buildings with ducts, abandoned utility vaults, pits, machinery housings, etc).

Discuss where, what sorts, what sorts of hazards.

“Silo for High-Moisture Shelled Corn”
© 2006 CC-BY Some rights reserved by “Don O'Brien”

60% of all confined space fatalities are of would be rescuers.

Stay out.

Hazardous atmospheres may include

- Low oxygen levels
- Enriched oxygen levels
- Flammable gases or vapors
- Toxic gasses (Carbon Monoxide, Hydrogen Sulfide, etc...)



One reason for the risk to would be rescuers:

Confined spaces may look fine, but contain toxic atmospheres.



Does this need to be searched?

Probably.

But not by you.

Record it.

Report it.



Structural Collapse

What sort of hazards do you see here in a disaster environment?

(Visible are at least: potential for Secondary collapse, Hazardous materials, Risks of fire, damaged utilities, electrocution, Debris....)

This is a very different sort of environment that search and rescue operations in a missing person incident.

Many many more concerns, including safety and logistics. Seek additional training for operations in this environment (including wide area search). Wilderness SAR resources may be asked to help in early phases of response in a local disaster.

A Fish and Chip shop in North New Brighton, Christchurch, NZ, on Feb 23, 2011. Courtesy of FEMA Hazards



But in normal missing person incident search and rescue incidents we:

Check Structures.

Structures can be abandoned....

What hazards might be present here?

Note old wells, rotten floors over basements, animals, humans, etc....

Structural Collapse

Risks in abandoned buildings and disasters

- Secondary collapse
- Toxic atmospheres
- Hazardous materials
- Risks of fire, explosion, damaged utilities, electrocution
- Collapsed floors, rotten floors, unsound floors
- Debris
- Animals
- etc...

Both abandoned buildings and disaster situations can have similar hazards around structural collapse.

Don't make assumptions about abandoned structures (the floor might not be there).

Maintain situational awareness. Assess hazards.

2-10-17 1530
HM – propane
OR-TF1

In a Disaster, USAR Structural Engineers mark for hazards:

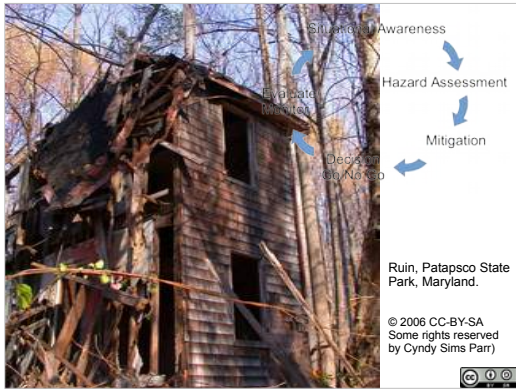
FEMA USAR Structure/Hazards Evaluation marking system.

Square: Low Risk for USAR operations.

Square with one diagonal: Medium Risk for USAR operations. May require hazard mitigation for search.

Square with X: High Risk for USAR operations, subject to sudden collapse. Significant mitigation required for rescue operations.

HM: Hazardous Material condition in or near structure



So, here's a structure you encounter during a missing person search.

Discuss (Cyclical Risk Management Process).

What is the situation?

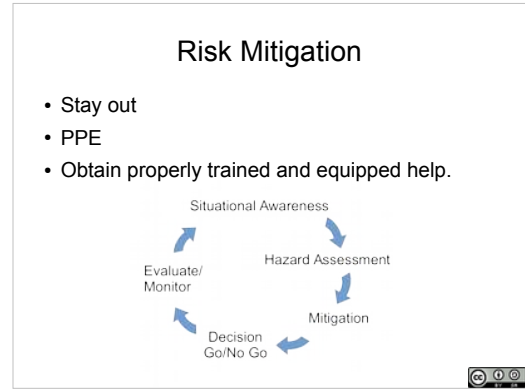
What hazards might be present?

What mitigation measures can you take?

Go/No-Go decision.

What are you going to monitor and evaluate if you enter?

How are you going to mark this structure?



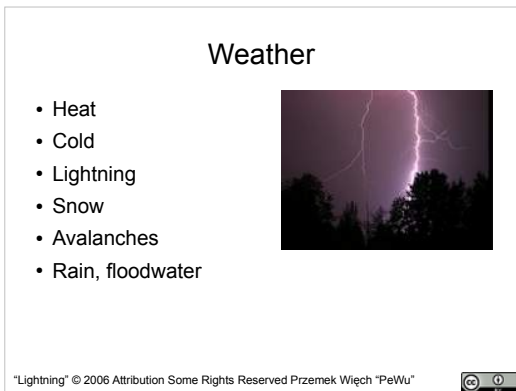
Situational awareness – it's an abandoned building, it has hazards.

Hazard assessment – what are the hazards

Can we mitigate them? Do we have the appropriate PPE, equipment, training, etc?

Go/No go decision – may very well be: No Go, mark the structure, call it in for properly trained and equipped resources to search it, and move on.

General risk management process applies to all technical rescue settings: water, confined space, structural collapse, high angle, etc.



Weather poses hazards (both in training and in searches)



If you can hear thunder, you should be in shelter.



Sign: © 2008 AttributionShare Alike Some rights reserved by Tony Bowden
Crash: © 2007 AttributionShare Alike Some rights reserved by Jason McDowell

Don't drive fatigued.

Pull over and rest. Stay home. Rest before returning from a search.

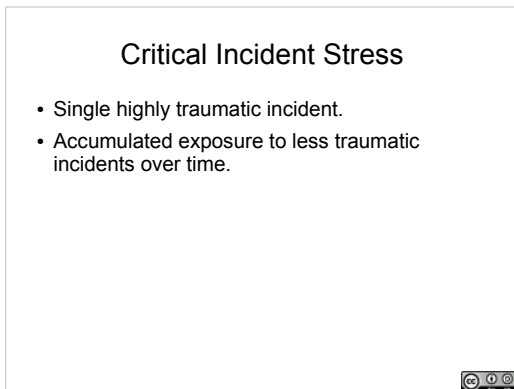
Goes for training as well – if you are too tired to drive out to a training, don't.

Fatigued driving has killed searchers.

In extended deployments, make sure that accommodation (including for canines) is quiet and restful.

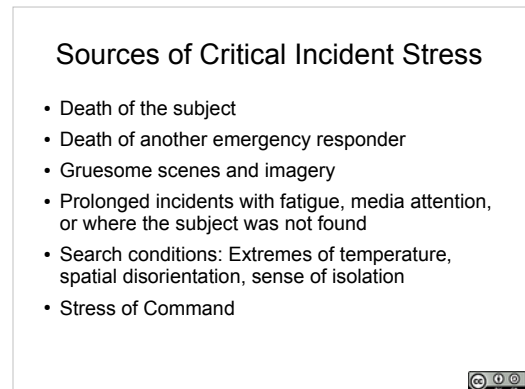


Exposure to bloodborne pathogens is a risk. You should be receiving regular OSHA compliant bloodborne pathogens training and refreshers.



Another risk in all emergency response is critical incident stress.

Critical incident stress can come from exposure to a single traumatic incident, or as accumulated exposure to smaller incidents over time.



Some sources of critical incident stress in SAR.

Prolonged incidents with fatigue.

Prolonged incidents, with fatigue, with media attention.

Prolonged incidents where the subject was not found.

All sound familiar to experience searchers.

Reducing CIS and Preventing CIS from producing PTSD

- Previsualize
- Limit exposure
- Search in teams of 4 or more people
- Keep everyone oriented to the map
- Critical Incident Stress Debriefing (by trained professionals)
- Take care of each other



Critical incident stress can progress to post traumatic stress disorder. Important to prevent this.

Previsualize: Include mulage in training. On a callout, visualize finding the subject deceased.

Control factors you can control. Limit your exposure to gruesome scenes. Don't go look unless you have to. Limit isolation – work in groups – field deployed resources in teams of at least 4 people. Reduce spatial disorientation, navigator keeps everyone oriented to the map, check your compass even if you aren't navigating.

After exposure to a stressful incident, seek critical incident stress debriefing from trained professionals (should be offered, but not mandatory.) **What are agency processes for setting up CSID debriefings?**

Watch out for each other day to day, look for any team member who is showing signs of stress or withdrawing.

Hazards for SAR Canines



We work with dogs, there are particular hazards for them as well.



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How do we mitigate this risk?

That's very much in the domain of the handler: Training a strong recall, strong leave it, train critters as distractions.

And, work to expunge self rewarding crittering behaviors.

Hazards for SAR Canines

- Poisons
- Human foods that are toxic for canines
- Other Animals (Porcupines, Snakes, etc.)
- Paw/Limb injuries
- Heat
- Automobiles
- Tick Borne Illnesses



Some hazards.

Discuss.

Discuss mitigation.

Note that common foods can be toxins for dogs: Chocolate, artificial sweetener Xylitol.

**Mitigation
(Poisons, Automobiles, Animals)**

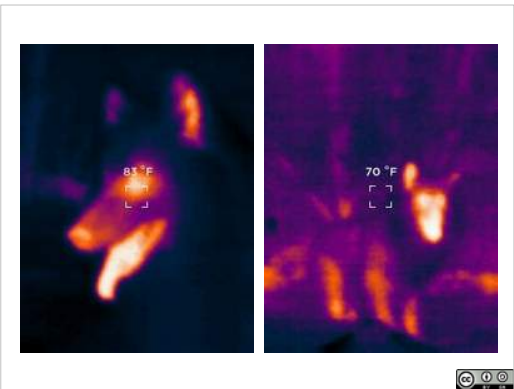
- Train a strong "Leave it".
- Train a strong recall.
- Train a strong "Safe".

- Canine Medical Plan – 24 hour emergency Vets
- Canine First Aid training for all team members.

Summarize discussion of mitigation measures.



Primary cooling mechanism is panting. Heat loss through evaporation, like us, but not through entire skin surface.



Here's some thermal images of a dog in the summertime – mouth is hot, primary heat loss through panting.

Dogs can overheat very easily.

How can we mitigate this risk?

Mitigation (Heat)

- In training, keep someone at the cars with dogs that aren't in the field all the time.
- Cooling Mats, Shade Cloths.
- Provide lots of opportunities for water
- Perforated Reflective Vest

Water, Shade, Ventilation. Monitor.

Carry lots of water. Provide your dog with water in their crate and lots of opportunities to drink when searching.



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