



Veterinary

# Considerations for Cold Weather Operations

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*Caring for the Search Canine in Cold Weather Conditions*

Cold weather operations present unique challenges to the working canine, handlers, and the medics purposed with their care. Preventative measures and situational awareness play a significant role in maintaining search capabilities at peak performance.

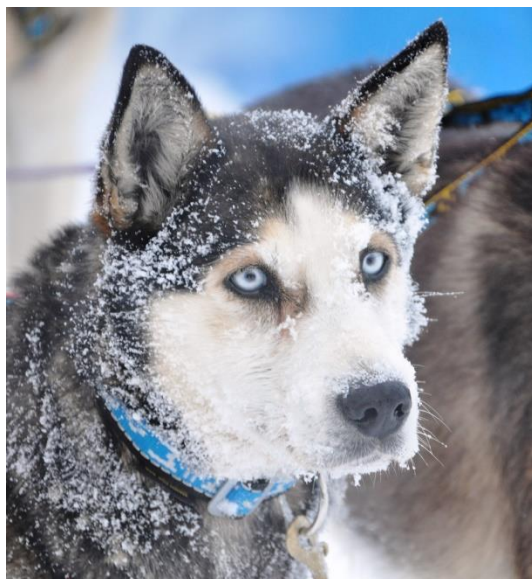
Lori E. Gordon, DVM  
MA-TF 1 US&R



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## I. Introduction

Like its counterpart 'extreme heat', cold weather operations present unique challenges to the working canine. Specific concerns range from the logistical requirements to several medical concerns, not only for the search canine but for their handlers and all the support personnel involved in the mission. In addition to the difficulties of search operations in extreme cold is the likelihood that a certain percent of the dogs will have had little to no time for acclimatization. Preventative measures and situational awareness will play a significant role in maintaining their peak search performance capabilities.

## II. Medical Supplies

### A. Equipment Failures

#### 1. LCD Screens

Most modern electronic displays are Liquid Crystal Displays. The liquid crystal fluid in the display is of prime importance. Different fluids have different temperature characteristics. It is up to the designer to select fluid that fulfills needed requirements.

- a. Temperature specifications for LCD fluids are in manufacturer data sheet.
- b. LCD's immersed in liquid nitrogen have been known to return to normal operation after a brief warm up.
- c. Example: LCD TV has an operating range 0°C (32°F) and 32°C (90°F). LCD's equipped with a thin film heater overlay can achieve response time equivalent to displays operating at 0°C (32°F) while operating at low temperatures.
- d. Increasing the power to the heater will decrease the warm up time, but will typically require 2 to 3 volts for every square inch of the display

#### 2. Batteries

- a. At -20°C (-4°F) most nickel, lead and lithium-based batteries stop functioning. Although NiCd can go down to -40°C (-40°F), the permissible discharge is only 0.2 Capacity (5-hour rate).
- b. Specially built Li- ion brings the operating temperature down to -40°C (-40°F), but only on discharge and at a reduced discharge.

#### 3. Stethoscope

- a. The polyvinyl tubing will freeze and crack if left exposed to extreme cold temperatures. The colder it is the less time on the open it will survive.
- b. Keeping the tubing inside your jacket or wrapping in warming packs are options to prevent this



**4. Thermometers**

Temperature accuracy in the dog is still rectal. Ear thermometers and temperatures taken at the underarms are neither accurate nor reliable.

- a. Use lubricated soft-tipped quick-read model.
- b. The less time you spend doing this (in any weather), the happier everyone will be. There are ones that give a reading in 10-15 seconds.

**5. Tape**

- a. The glue tends to harden and tape won't stick as well or at all.
- b. This is a deceptively minor issue until you realize how often tape is used and how much you need it.
- c. Keeping these items warm (pocket, warming packets) is the best way to preserve their function

**6. Pens and Pencils**

- a. Any liquid-based piece of equipment has the potential to fail in extreme cold
- b. Record keeping is of great value in documentation of a patient's condition, treatment, and continuity of care.
- c. Pencils function well in any weather.

**B. Drug Administration**

**1. Injectable Drug Inspection**

- a. Crystallization and color changes are indicative of a problem with an injectable drug. Warming may dissolve crystals; otherwise the drug should not be used.
- b. If the syringe or tubing is cold, they may recrystallize and should be inspected again within the delivery system.
- c. Ideally these are administered in a warm environment, but circumstances may be otherwise

**2. IV Lines**

- a. These harden in extreme cold, as well as any liquid within them.
- b. Ideally any intravenous needs are performed in a warm environment. Otherwise warming packets can be used to mitigate the difficulties.

**3. Syringes, needles**

- a. Keep warm in extreme cold temperatures as any liquids can freeze and/or crystallize within the chamber.

### III. Canine Treatment Considerations

There are three treatment considerations that are not performed when operating in extreme cold weather. They have the potential to increase potential for frostbite and/or hypothermia.

#### A. No Clipping of Hair

1. The main functions of the hair coat are to protect the skin and to help regulate temperature. Fur traps air, which provides a layer of insulation against the cold. Small muscles attached to the guard hairs allow dogs to raise these hairs, which improves air trapping. Sebaceous (oil) glands within the skin lubricate the hair, keeping the coat shiny and water resistant.
2. Different breeds of dogs have different types of hair coats. Breeds from northern climates (such as Huskies and Malamutes) have a soft, downy undercoat that provides better insulation in cold weather. Water breeds (retrievers, for example) have more long and stiff guard hairs to protect the skin and undercoat from harsh environmental conditions. Water breeds also have ample oil secretions to lubricate the hair. Breeds from warmer climates have shorter coats designed only to shade the skin.
3. Without these protective properties, the skin is more easily subject to frostbite. In addition, once affected, the area becomes more prone to frostbite in the future.

#### B. No Isopropyl Alcohol

1. Isopropyl alcohol evaporates quickly and dissolves oils, leaving behind almost zero oil traces. This removes the lubrication and water-resistance properties of the skin
2. This evaporation also has cooling effects, better suited for hot environmental conditions (in limited use) but not indicated in extreme cold.
3. Water-based antimicrobial solutions may be substituted if desired

#### C. No Subcutaneous Fluids

1. These have the potential to freeze under the skin in extreme cold conditions
2. If given in a warmed environment but not completely absorbed before being sent out to search, they will become cold and increase potential for hypothermia



## **IV. Canine Health Issues Awareness**

### **A. Hyperthermia**

Hyperthermia occurs in cold weather as well as in warm environments. High-drive 'hot-blooded' dogs may normally run a little higher than the average (normal temperature range is 100-102.5°F/38-39°C). It is not uncommon for FEMA search dogs to run at 103°F (39.5°C) or higher. The key is to look at the whole dog – check vitals, attitude, and any abnormal symptoms that indicate there is a problem.

1. Hyperthermia is defined as a temperature of > 103°F (39.5°C) after 30-60 minutes of rest.
2. More common working in calm, sunny days, ambient temperatures above 32°F (0°C)
3. Dark color haired dogs will absorb more heat and are more susceptible
4. Rectal temperature is the best measurement
5. Associated signs include hyperemic and dry mucus membranes, excessive panting which may become shallow respirations later, hyperdynamic pulses early on which may become weak pulses later, gait change, weakness, weaving/unsteady, eventual collapse, vomiting and diarrhea.
6. Treatments include remove from direct sun/shade, snow or cool pack limbs, cool IV fluids, stop cooling at 103.5°F (40°C) to avoid becoming hypothermic
7. After treating a dog for hyperthermia, they should not be placed back in search operations; complications may not be immediately apparent and they will be more susceptible to hyperthermia in the future

### **B. Hypothermia**

High wind chill factors, combined with dehydration and depleted energy (fat) reserves can be deadly if caught out in the cold.

1. Hypothermia is defined as a temperature of < 37°C (99°F).
2. More common working in cold, cloudy, windy days
3. Light color haired dogs will reflect more heat and are more susceptible
4. Rectal temperature is the best measurement
5. Associated signs include shivering (this is lost at < 31°C/88°F), diminished reflexes, decreased awareness, weak or absent pulses, bradycardia (HR <60 bpm), and cardiac arrhythmias
6. Treatments include remove from cold, provide shelter and warmth, dry if wet, wrap in blankets, warm IV fluids, keep dog horizontal and avoid massaging limbs that may lead to vasodilation and cardiovascular collapse; rewarm at < 1°C (2°F) per hour, stop rewarming at 36-37°C (98-99°F) to avoid becoming hyperthermic
7. After treating a dog for hypothermia, they should not be placed back in search operations; complications may not be immediately apparent and they will be more susceptible to hypothermia in the future

### C. Dehydration

Dehydration makes everything worse.

1. Fluid loss is primarily via panting and is mostly water
2. Associated signs include tacky (sticky) mucus membranes, increased heart rate (>150 bpm), decreased skin elasticity, decreased urine output, dark concentrated urine
3. Treatments include rehydration via oral water intake (preferred if caught early), subcutaneous fluids (not if extreme cold – may freeze under skin), and intravenous fluid administration. Lactated Ringers is preferred, but sodium chloride is fine.
4. Flavoring water with canned dog food works well. Avoid additives high in sodium and potassium as dogs lose mostly water, not electrolytes like humans
5. After treating a dog for dehydration they may be placed back in search operations and monitored for water intake and hydration needs.

### D. Frostbite

Frostbite refers to a condition of avascular necrosis caused by the freezing of body tissue.

1. Conditions for occurrence include tissue temperature below 93°F/34°C, freezing of exposed body part, and contact with cold liquid, glass, or metal
2. Signs include pale to cyanotic (blue) tissue, cold to the touch, extremely painful to non-painful (depending on depth damage)
3. Thawing of the area leads to erythema (redness), pain, swelling and edema
4. Treatments include removing dog from the cold, warming the affected area, DO NOT RUB which causes tissue damage, topical antibiotics/aloë then bandage gently, analgesics, prevent self-trauma and protect from refreezing; allow time to heal before removing apparently dead tissue as much may return to normal.
5. The area will be more susceptible to frostbite in the future
6. Areas of concern include
  - Ear tips and tail tips
  - Collar and bootie rubs
  - Axillae and flank folds
  - Nipples and vulva in the female
  - Prepuce and scrotum in the male



### E. Paw Pad Injury

The paw pads and lower limbs, being without protective gear, are subject to a lot of wear and injury. Even sled dogs with booties develop injury, especially with hard packed snow.

1. Lameness is the most common sign, sometimes spots of blood will be seen on snow
2. Treatments include topical antibiotics and bandaging
3. Adequate bandage booties resolve lameness and allow for the canine to continue search operations. A 7-layer boot system was developed for the dogs at the SR-530 Landslide deployment in Oso, Washington.

- Stirrups – made with tape
- Antibiotic-treated gauze - on wound
- Cast padding – cotton layer
- Stretch gauze – binding layer
- Vet wrap – water resistant layer
- Elastikon® - protective layer, expands, with good sticking properties
- Duct Tape – ultimate protective lay



## V. Preventative Measures

### A. Work-Rest Cycles

1. FEMA guidelines during a 12-hour shift are for every 20-45 minutes of work, allow for an equal time of rest
2. Modifications are made based on the mission, conditions, and canine health
3. Awareness of this issue minimizes fatigue and illness, maximizes performance efficiency and safety

### B. Real Rest

1. Quality of rest is as important as the quantity
2. Ideally in a shelter, in a crate, which insulates canines from the noise and activity
3. A chance to rehydrate, warm up, and recuperate to be at peak search performance

### C. Adequate Caloric Intake

1. Fat has 2.25 times as many calories as protein or carbohydrate.
2. Dogs not sufficiently adapted to higher fat intake may develop diarrhea.
3. Premium kibble food designed specifically for sled dogs is the best source of protein.
4. Plan on double amount of food; order early!
5. Feed multiple meals rather than 2 big meals to avoid Gastric Dilatation Syndrome ('Bloat')

### D. Hydration

1. Monitor mucous membranes, urine output, skin
2. Offer fresh water after each search
3. Flavor water to encourage drinking as needed

### E. Regular Medical Checks

1. Pre-shift, during shift, and post-shift
2. Medics, MDs, Veterinarians, Handlers
3. Minimum: **HAW/L** – HAW is the musher's command for left turn
  - H** = Hydration, Heart (pulse if no stethoscope)
  - A** = Attitude, Appetite (bright and alert? Or lethargic, 'off')
  - W** = Weight (weight loss has been documented from 3 to 13%)
  - L** = Lungs (no stethoscope? Listen for harshness, rate, unusual noise, or cough)
4. Watch their gait as a canine enters or leaves a search area



## Decontamination

### F. Logistics

1. *Shelter* – especially from the wind
2. *Heated inside*
3. *Soap and Warm Water* – dishwashing soap is fine initially, but the detergent will wipe out the oils needed to help protect the skin and keep water off. Dog shampoos are formulated to minimize this.
4. *Drying* will prevent hypothermia from occurring



### G. Minimal water options

1. Superficial decontamination with moist wipes
2. Anivac – a self-contained ‘dry-vac’ for dogs

### H. Mass Decontamination Units (MDUs)

1. FEMA cached human decontamination systems available
2. FEMA cached canine decontamination unit listed under Technical Section, canine Search Equipment, TG-0109.00 to TG-0109.35
3. Washington National Guard decontaminated search dogs in their units

## VI. Personal Protective Equipment

### A. Canine

Traditionally FEMA canines perform search operations without any gear due to concerns about collars or vests becoming entangled in debris and causing them harm. Circumstances may arise in which certain gear may benefit the canine with regards to protection and preventative measures against cold and injury.

1. **Booties** – Dogs have tough pads on their feet but also there are sweat glands, where moisture collects. This tends to attract snow which melts and forms balls of ice. Even with those tough pads they may be vulnerable to damage on icy conditions. Dog booties provide a layer of protection to the dog’s pads.
  - a. *Sled dog booties* are usually made from Codura material with Velcro attachments. They are disposable, thin enough for some traction. In cold climates but no snow, most dogs will be fine without pad protection. Be aware that pad wounds are among the most numerous incurred by canines in the field.
  - b. *Medical booties* may be needed to treat and protect cuts and bruises, but can still allow the canine to continue search operations (see Paw Pad Injury section IV E).

2. **Vests** – Neoprene vests offer several potential advantages in cold, wet conditions. They have been vetted for use at the SR-530 Landslide deployment in Oso, Washington. The advantages discovered include:

- Protection from the rain, wind, and cold
- Protection from debris wounding
- Form-fitting for decreased snag concerns
- Easily trimmed to fit better at underarms and groin



## B. Human

During a 12-hour shift temperature differentials may vary 30 degrees or more. Weather (wind, humidity, precipitation) in addition to activity level (standing, navigating varied terrain), also affect conditions. Some basic guidelines include:

- *Layering* to allow adjustment to wide range of temperatures, trapping warmth between layers when needed
- *Wicking* materials (as opposed to absorptive, like cotton) to keep skin dry and wick sweat away from the body
- *Rating* of -40°C (-40°F) is recommended for all clothing and sleeping bags
- *Extra pairs* of gloves and socks carry with you or have very close by

### 1. Head, Neck, Hands and Feet

- Head and neck* generate and lose heat rapidly. Warmth then wind protection are layered. Cut small holes to allow placement of stethoscope tips through rather than lift hat edges which exposes ear lobes to frost bite. Examples: balaclava, fleece or pile insulated, outer layer hood; neck gaiter (longest one you can)
- Bare hands* are best for palpation (pulse, injury) and mucous membrane checks (color, refill, and hydration) but rapidly become numb in cold/wet conditions. Options include fingerless gloves inside mittens, and hand warmers kept inside the mittens or in jacket pockets after quick use of bare hands. Examples: Polypro, fingerless and lightweight army surplus wool gloves, wrist gaiters, fleece/mitt inside lined gloves. Carry extra liners and gloves to replace wet ones.
- Cold/wet feet* can make a shift quite miserable and lead to multiple medical issues. If boots do not cover calf, use gaiters to prevent snow from getting into boots. Toe warmers are also helpful. Carry an extra pair of each layer. Sock Examples: nylon or silk liners then a wool blend. Boot Example: LaCrosse or Sorel Pac Boots, Cabelas Trans-Alaska Pac Boots, Neos overshoes, Mukluks.
- Ski goggles* to protect eyes

## 2. Upper Body

- a. Polypro/silk T-shirt for inner layer
- b. Insulated jacket/fleece sweater/vest - middle layer (in extreme cold)
- c. Insulated roomy anorak or pullover or parka with insulated hood

## 3. Legs

- a. Long underwear bottoms - inner layer
- b. Fleece or wool pants - middle layer (for extreme cold only)
- c. Nylon wind pant with knee pockets for foam insert/insulated pant, bib - outer layer



## 4. Other

- a. Wrist watch - lifting sleeve to use a wrist watch exposes skin to the cold. A watch can be fitted with a large elastic cloth band to fit over the outer jacket sleeve for quick, convenient, easy use. Bands are at fabric/sewing stores.

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