



# Canine Decontamination



## Guidelines for Emergency, Gross, and Technical Decontamination of the Urban Search and Rescue Canine

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## INTRODUCTION

During the course of a search, canines may be exposed to hazardous materials. Exposure to contaminants can range from the most benign dirt to potentially life-threatening hazardous materials and weapons of mass destruction, including chemical, biological, and radiological substances. They are encountered during natural disasters like floods, hurricanes, and earth quakes, as well as man-made accidents like fires and explosions, and terrorist events.

These contaminants may come in several different forms, including solids, liquids, powders, and gas. Search and rescue operations involve the sorting of collapsed materials, aerosolizing any hazards that may otherwise settle during a deployment. Working without the personal protective equipment that humans use, a search canine's risk of exposure is increased. In addition, many hazardous materials are heavier than air and tend to pool low to the ground, where canine exposure is high.

Decontamination of animals is an important component of responsible emergency response management and is a recognized part of an emergency response plan. The importance is for the health and well being of the animals affected as well as the humans to whom they may transmit hazardous materials.

This paper is designed specifically as a guide to the practical, day-to-day operations of providing a means of decontaminating a canine in the variety of situations that may occur. Hazmat-related information on contamination detection, avoidance, and identification are covered elsewhere by multiple sources. Common hazards and canine medical issues are touched on briefly, with greater detail also available elsewhere.

Much of the information regarding the practical operations is directly due to the continued dedication and hard work of the members of the Massachusetts Task Force 1 Urban Search and Rescue team, of which I am honored to be a member. I wish to thank them for their tremendous support in my efforts to expand our decontamination protocols, and the obvious care they have for our search canines. I also wish to thank the handlers for their help, and especially the search canines who put up with lots of bathing!

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## I. TERMS and DEFINITIONS

When discussing decontamination there are two basic levels: gross decontamination and technical decontamination. Whether one, the other, or both are used is dependent on the particular contaminant or hazardous material involved. Having a system on site with the ability to adapt to a range of needs, from benign to emergent, is important. This will allow protection and provide safety to the canines, their human partners, and everyone else around them.

### A. GROSS DECONTAMINATION

This is an initial phase of the decontamination (decon) process during which the bulk amount of surface contaminant is significantly reduced. It is designed to be done quickly.

Two types of gross decontamination are described: emergency and non-emergency.

1. Emergency Gross Decontamination is used to immediately reduce contamination of those with potentially life-threatening exposure, where immediate medical attention is required. The goal is to save lives.
2. Non-Emergency Gross Decontamination is bulk removal of a non-life threatening contaminant, also designed to be done as quickly as possible.

### B. TECHNICAL DECONTAMINATION

This process involves an established corridor, specific stations, and detailed guidelines designed for complete removal of contaminants, leaving no residual hazard, and addressing the medical needs of victims and responders as needed. This is a meticulous process to remove as much contaminant as possible utilizing several methods such as brushing, vacuuming, adsorption, absorption, washing, chemical detoxification, chemical neutralization, and others.

Two types of technical, also known as thorough, decontamination are described: (1) emergency, which includes a medical component, and (2) non-emergency, which may or may not involve a medical component.

1. Emergency/Medical Technical Decontamination refers to a Hazardous Materials (Hazmat) or Weapons of Mass Destruction (CBRNE) situation, where complete decontamination is a necessary component of the medical treatment in a life-threatening situation
2. Non-emergency +/- Medical Technical Decontamination refers to a contaminant that is not immediately life threatening, but must be removed completely to avoid future complications. Regardless, a medical check is always recommended.

♫ **NOTE:** The need and ability to medically treat a canine before reaching the decon corridor is based on several factors: a life-threatening status, medical personnel presence within the hot or warm zone, on site medical supplies, and safety of involved personnel.

## II. CANINE FACTORS TO CONSIDER

Canine and human share many properties when confronted with contamination. Decontamination and treatment methods for both are also similar, and therefore familiar, to first responders. However several important differences do exist, such as anatomy, search methods, PPE, and behavior. It is important to become familiar with the special considerations for canines in order to effectively decontaminate without doing further harm to them well as the humans involved. In addition to canine-specific decontamination units many human decontamination systems are easily adapted for our working canine team members.

### A. EXPOSURE – ROUTES, ANATOMY, BEHAVIORAL ASPECTS INTERMITTENT CARE and PREVENTION METHODS

#### 1. Ocular – the Eye

- ☉ Situational aspect is that there is no eye protection worn by the canines during search and their head (therefore their eyes) is often close to the ground, where contaminants may concentrate. Sniffing also aerosolizes particles into the eyes
- ☉ Anatomically the canine eye is similar to the human eye except for the third eyelid, and is treated for injury/irritation in like manner
- ☉ Options are rinse eyes, place canines in protected environment away from dust and debris, and treat appropriately (veterinary check; fluorescein stain)
- ☉ Ointments should not be used until complete removal of contaminant as it may trap a chemical agent against the cornea causing further damage
- ☉ Goggles designed for dogs are available; familiarize in training before introducing them at disaster
- ☉ Conjunctival irritation was most common injury documented in New York State Police Canines at the World Trade Center terrorist attack (62.9%)

#### 2. Inhalation – Nose and Mouth

- ∞ Scent, the canines' main search tool sense, is used to its utmost without the protective benefits of respiratory protective gear. The respiratory system also receives increased exposure if a contaminant is concentrated on or near the ground. Often you see a canine's mouth is open, taking in scent to the back of their throat where it circulates up and over the soft palate to the scent glands within the nose. This presents an ingestion hazard as well (next section).
- ∞ Anatomically there are advantages and disadvantages to their particular nasal traits: the relatively long length and intricate inner 'scrolled' surface area allows for better trapping of particulate matter before it reaches the lungs, and canine lung defense mechanisms and mediators of inflammation also contribute to disease resistance, but the sensitive and vascular mucosal surface may absorb contaminants into the blood stream as well
- ∞ Options include rinsing the nose (a rather unrealistic and problematic solution when put into practice) but dogs have a great response: sneezing! Some can be trained to sneeze, utilizing this natural response when held upside down and the fluid shift leads to a sneeze response, then rewarding.

### 3. Ingestion – Behavioral Aspects, Tongue Exposure

- ◆ Search canine training emphasizes ignoring tempting items like chasing after scurrying animals and taste testing along the way. But hunger, and more of a concern – thirst, may override even the best trained.
- ◆ Inhaling scent through the mouth, bringing it to the caudal palate over where scent cells reside, or even just panting, brings aerosolized contaminant particles in where they may be swallowed.
- ◆ Behavior also plays a role: licking to clean off fur and paws increases ingestion exposure if those areas were contaminated.
- ◆ Options include maintaining hydration (decrease desire to drink from puddles), periodically using baby wipes to face and any other place they lick.

### 4. Dermal – Skin and Fur; Ears and Tails

- 🐾 Without personal protective equipment, a search canine’s entire body is exposed to all manner of contaminants and physical hazards.
- 🐾 Anatomically their particular skin and fur make-up has both advantages and disadvantages ( inner ear flap, or pinna, is considered part of the skin):
  - *Advantage:* fur can trap contaminants, keep them from contacting skin, especially if the agent is caustic or burns;  
*Disadvantage:* this fur ‘trap’ also makes decontamination more difficult and may hide wounds for hours to days
  - *Advantage:* ears offer some protection, especially if flopped over, and the canal takes a 90° turn instead of going straight to the tympanic membrane  
*Disadvantage:* less-haired areas susceptible to exposure (some are thin-layered and more susceptible to wounding): inner ear pinnae, tip of nose, axilla (arm pit), underbelly, inner flank, scrotum, paw pads
  - *Advantage:* the tail may be tucked in tight to the body, protecting mucosal perineal and vulva areas  
*Disadvantage:* the tail may trap contaminants underneath; don’t forget to decontamination under and around the tail (a favorite greeting ritual)!
  - *Advantage:* paw pads are thick and tough, great protection.  
*Disadvantage:* paw exposure to the environment during urban search make them one of the most compromised and wounded parts of the canine body; sweat glands will absorb nerve and other agents
- 🐾 Options to decrease contamination include periodic wiping, palpating for wounds, and thorough decontamination appropriate to the situation at the end of the shift, even during a shift if deemed appropriate
- 🐾 Regarding wipes, avoid alcohol-containing wipes that may dry paw pads and cause cracking of their surface. Also dry wiped areas well to decrease attracting more contaminants
- 🐾 Booties provide protection to the vulnerable paw pads when tracking over rubble, but there is concern about decreased traction. Several products are available on the market. Familiarizing canines with booties at training may come in handy in certain search situations (building search)

## 5. Injection

- † Urban search is fraught with physical hazards, including some very sharp debris. The lack of PPE increases the risk of wounding as well as contamination by injection into the body. This may be in the form of punctures, scrapes, burns, or lacerations.
- † Wounds are an entry point into the body's vascular system. Behaviorally a canine licks their wound, further increasing contamination by ingestion. The compromised tissue may be very small or quite obvious.
- † Options include being vigilant with observation and hands-on checking of the canine. It falls to the handler, especially if medical personnel are not directly present, during search. Then after decontamination it is recommended that a veterinarian or medical personnel examine them.

## 6. Hydration

Maintaining adequate hydration, in cold weather as well as warm, is a constant challenge. Many canines defer drinking due to the excitement and stress levels.

- Encourage drinking of bottled water in small, frequent amounts.
- Maintenance ~ 2-4 ml/kg/hr; additional for heat, workload, time
- Flavoring the water is an option (careful with electrolytes)
- Dehydration documented in 48.1% of NYC Police canines at WTC

## 7. Work-Rest Cycles

This is an important aspect in maintaining health, minimizing accidents

- Minimizes fatigue, illness; maximizes search efficiency and safety
- FEMA guidelines: for every 20-45 minutes of work, equal time rest
- Fatigue was the other most common documented injury reported in New York State Police Canines at the World Trade Center attack (62.9%)

## B. CANINE WORK ENVIRONMENT – Ambulation, Proximity, PPE

Working canines are typically without protective gear. The tools of their trade - eyes, nose, and mouth – are low to the ground, their body height is 2-4 feet below our standing height, and their paws are subjected to the environment on which they are traveling.

Many hazardous substances concentrate on the ground or other low surfaces where canines work. Chemical agents disbursed as gas or aerosol may be heavier than air, pooling near or on the ground. Without PPE, working low to ground, walking on 4 unprotected paws increases their risk of exposure.

## C. CANINE METABOLISM

It is not policy to intentionally send canines into potentially fatal or devastating hazards. But even the most meticulous area assessments may be limited in their scope. When weighing a potential live-victim find against hazards, some risk may be assumed. Risk assessment allows for an informed decision regarding the use of search K9s in the field. Their sensitivity and exposure to certain hazards allows for a more informed decision.

Metabolic differences between humans and canines may be difficult to qualify or quantify. These play a role in the determination of risk to the first responders as well as the search canines. Although canines vary as more, the same, or less sensitive to various contaminants, how much they are affected depends on many factors: personal health, condition, and age; concentration of and length of exposure to contaminant. The exception to this may be their sensitivity to radiologic exposure.

Level of decontamination and treatments should be based on signs and symptoms. Toxidromes and further diagnostics are then used to determine the underlying etiology in order to administer antidotes and monitor certain values.

### III. CHEMICAL, BIOLOGICAL, RADIOLOGICAL AGENTS

#### A. General principles

1. **Sensitivity** to agents of concern may be utilized as a guide for risk assessment when deciding to send canines into an area with a known potential hazard
2. **Signs of toxin exposure** (chemicals, blister agents, nerve agents, blood agents) can be seen in both humans and canines:
  - Cough, choking, gasping for air
  - Red eyes and gums, tearing, salivation
  - Pupils pinpointed or dilated
  - Nausea, vomiting, abdominal cramps, diarrhea, fatigue
  - Muscle twitch, disorientation, seizure, paralysis, urination/defecation

Other signs are difficult to detect, recognize or confirm in the canine:

- Headache
  - Chest tightness
  - Sweating – detectable in the poorly-haired areas of the body (axilla/arm pits, flank/upper-inner thigh) and paw pads
  - Skin rash – if not on poorly haired areas, fur makes it difficult to visually detect redness and rashes until the skin begins to ooze from secondary infection and inflammation.
  - Small wounds (punctures) and burns (thermal or chemical) will occur, but not as obvious blisters. Wetness and pain from the injury can be detected on the skin during medical checks.
3. **Decontamination level** will vary depending on several factors
    - Available water, supplies, equipment
    - Technical versus gross
    - Emergent versus non-emergent
    - Scene and personnel safety
  4. **Medical treatment** often includes the decontamination process. In addition some exposures require further medical care, including antidotes and other drugs including topical, inhalant, and injectable
  5. **Preventative measures** for specific agents range from environmental protection (sheltering), canine-specific PPE, and prophylactic medications.

## B. TOXICOLOGIC AGENTS of CONCERN for DECONTAMINATION

Toxicology experts have named some of the more common substances, but not all, that may be encountered by an urban search canine. Descriptions and details are available at multiple book, internet, and 'app' sources. The importance of their decontamination lies with the health of the canine and everyone with whom they may come in contact.

1. Hydrocarbons
2. Polychlorinated Biphenyls
3. Hazardous Metals
4. Asbestos
5. Soaps and Detergents
6. Acids and Alkalis
7. Ethylene Glycol
8. Propylene Glycol
9. Phenol
10. Alcohols

## C. ENVIRONMENTAL TOXIN EXPOSURE – WORLD TRADE CENTER

A study was performed (ref #4) to assess environmental toxin exposure of the New York Police Department working canines. The twenty-seven canines tested were divided into prolonged exposure and brief exposure groups. All were deployed during the initial three weeks after the attack. Blood and hair samples were obtained for toxicologic evaluation, including many of the agents of concern described in the previous two pages.

References cited in the paper analyzed the air surrounding ground zero, which contained clouds of visible particulate matter: cement, glass, fiberglass, asbestos, and lead. Jet fuel combustion and structure fires resulted in release of soot, dust, polychlorinated biphenyls, chlorinated hydrocarbons, and dioxins. Clean-up operations continued to release polycyclic aromatic hydrocarbons.

Results for the canines included the following:

1. **Blood lead** concentrations (normal < 10  $\mu\text{g}/\text{dL}$ )
  - a. Significantly higher in 17 prolonged exposure K9s compared to brief exposure
  - b. Clinical signs of lead toxicosis were not appreciated in these canines
2. **Polychlorinated biphenyls**
  - a. All blood concentrations were less than the limit of detection
  - b. Dust samples collected at the site had low concentrations
3. **Metals**
  - a. Serum copper, iron, zinc, and magnesium were detected
  - b. All levels were within reference ranges
4. **Arsenic**
  - a. 21 of 25 canines tested had detectable levels, all within normal ranges
  - b. 2 canines had levels of 0.56 ppm, more than background threshold of 0.4 ppm
5. **Environmental toxins** – detected in 22 of 27 canines (81%)
  - a. 3-methyl quinoline
  - b. Isoquinoline
  - c. Quinoline
  - d. 2-(1-phenylethyl) phenol
  - e. Diphenylamine
  - f. Surfynol
  - g. Cedrol
  - h. **Negative for** polycyclic aromatic hydrocarbons: naphthalene, acenaphthalene, anthracene, fluorine, phenanthrene, fluoranthrene, pyrene, chrysene, others.

## **D. CHEMICAL AGENTS**

Threat chemicals are classified into industrial, warfare, and riot control agents. These may be incapacitating or lethal. Lethal substances include choking, blood, blister, and nerve agents.

### **1. Nerve Agents – Cholinergics**

These are the most toxic of warfare agents. They have a rapid onset of action and can gain access to the body via multiple routes of entry. They include Tabun (GA), Sarin (GB), Soman (GD, GF), V-agent/Venom X (VX)

#### **a. Physiology**

1. Inhibit acetylcholinesterase, the enzyme that neutralizes the neurotransmitter acetylcholine at nerve-muscle or nerve-gland junction
2. Affects the Peripheral Nervous System where ACh acts on 2 different receptors:
  - Nicotinic - neuromuscular junction of skeletal muscles, post-ganglionic neurons of parasympathetic NS, some brain neurons
  - Muscarinic - neuromuscular junction of cardiac & smooth muscle, glands, post-ganglionic neurons of sympathetic NS
3. "SLUDGE" and "DUMB BELS" symptoms
4. Affects the Central Nervous System as well

#### **b. Canine Sensitivity (w/r to humans)**

1. Tabun (GA): ¼ sensitive inhalation form, ½ sensitive to dermal form
2. Sarin (GB): ¼ sensitive inhalation form; twice as sensitive dermal form
3. Venom X (VX): about same sensitivity to inhalation and dermal forms

#### **c. Prevention**

1. Protective sheltering
2. Chemical impervious barriers on paws – butyl-rubber gloves, polyethylene bags, MRE outer bag
3. Skin Exposure Reduction Paste against Chemical Warfare Agents (SERPACWA) on non-haired areas (inner ear/pinna, axilla/armpit, flank/groin)
4. Prophylaxis with Soman Nerve Agent Pyridostigmine Pretreatment (SNAPP) not documented in canine; toxicity mimics nerve agent exposure

#### **d. Symptoms**

1. Early Effects are mainly muscarinic signs:  
Miosis, involuntary urination, defecation, hyperpnea, bradycardia, excessive lacrimation, hypersalivation, dyspnea (bronchoconstriction), tachycardia (catecholamine release)

2. Late Effects are nicotinic and CNS related:  
Nausea, vomiting, generalized weak, drowsy, ataxia, seizures, cyanosis, respiratory arrest, muscle fasciculations, confusion, anxiety, hyperthermia, flaccid paralysis, collapse, unconscious, coma, death

**e. Decontamination**

1. Military – wipe with M291 Skin Decontamination Kit (SDK) Pads (not around eyes, can damage)
2. Military – apply Reactive Skin Decontamination Lotion (RSDL)
3. Flush dermal wounds with copious amounts of soap and water
4. Flush eyes – saline, water
5. Technical decontamination with 0.5% sodium hypochlorite (1:10 bleach) 2-5 minutes, then rinse well

**f. Antidotes**

1. Nerve Agent Antidote Kit (Mark 1) – 1 to 2 auto-injections of 2-PAM Cl and 2-3 auto-injections of Atropine
2. Antidote treatment Nerve Agent Auto-injector (ATNAA) – 1-2 injections
3. Convulsant Antidote for Nerve Agent (CANA) – 1 auto-injection; repeat if still seizing

**Specific individual drug dosing**

1. **Atropine sulfate** @ 0.2-2.0 mg/kg; give ¼ dose IV, rest IM or SC; repeat if necessary based on the reappearance or persistence of respiratory signs (not based on salivation or miosis); drug effects last 4-6 hours...avoid overdose!
2. **Pralidoxime chloride** (2-Pam) @ 20-50 mg/kg IV SLOWLY or SC every 12 hours. Start with low dose; if no response after 3-4 doses discontinue
3. **Diphenhydramine** 1-4 mg/kg IM or PO every 8 hours to relieve muscle tremors. Start with lower dose if giving IM
4. **Diazepam** @ 5-10 mg IV; poorly absorbed IM, injection is painful. Midazolam at the same dose is a better alternative for IM administration w/r to absorption and less painful

**g. Treatments**

1. Induce emesis only if ingestion was within last 60 minutes and patient shows no clinical signs (hydrogen peroxide, apomorphine)
2. Perform gastric lavage if possible; alternatively administer activated charcoal (activated charcoal may be indicated for dermal exposure due to absorption)
3. Clear airway of fluid, provide oxygen
4. Secure airway if needed, ventilate, 80-100% oxygen for at least 30 minutes
5. Vitals monitoring – ECG, BP, PO, CO<sub>2</sub>
6. Treat hyperthermia
7. Supportive care

## 2. **Blister Agents - Vesicants**

Irritation and wounds are caused by direct contact with liquid or with high vapor concentrations. The eyes are the most sensitive organ. Warm, moist, thin-skinned areas (abdomen, axilla, flank) and respiratory tract are most sensitive. Open sores are susceptible to infection and take a long time to heal. These include Mustard Agents (H, HD, HN-1, HN-2, HN-3), Phosgene Oxime (CX), and Lewisite (L) which is an arsenical compound

### a. **Physiology**

1. Blister agent damage mechanisms of skin and cornea not understood.
2. Exposure times and agent concentration affect severity of damage
3. Respiratory tract exposure leads to severe mucosal tissue irritation, causing fluid secretion. This disrupts oxygen transfer within the pulmonary alveoli. Victims may also be susceptible to pneumonia.

### b. **Sensitivity (w/r to humans)**

- HD:  $\frac{2}{3}$  as sensitive to inhalation form;  $\frac{1}{4}$  as sensitive to dermal form

### c. **Prevention**

1. Chemical impervious barriers on paws – butyl-rubber gloves, polyethylene bags, MRE outer bag
2. Skin Exposure Reduction Paste against Chemical Warfare Agents (SERPACWA) on non-haired areas (inner ear/pinna, axilla/arm-pit, flank/groin)

### d. **Symptoms**

1. Mustards – delayed symptoms
  - Eyes: corneal/conjunctiva irritation, tearing, light sensitive, blind
  - Skin: red moist skin, swelling within 2-3 hours, piloerection
  - Respiratory: nasal discharge, dry cough, hoarse bark, nausea, vomiting, fever, dyspnea, hemoptysis
2. Lewisite, Phosgene – acute symptoms
  - Eyes: tearing, painful swollen lids, corneal scarring, iritis, blindness within 1 minute
  - Skin: red within 30 minutes, pain, itching, deep burns
  - Respiratory: profuse nasal secretions, violent sneezing, cough, frothy mucous, pulmonary edema
  - Systemic: restless, weak, hypothermia, low blood pressure

♪ **NOTE:** Canine dermal blood supply and skin reaction to chemicals differs w/r to human skin in that they do not develop blisters. Rather their skin becomes moist and hyperemic (reddens). Depending on the extent of the damage, skin may slough away, leaving open wounds. Because of their furry coat, meticulous physical examination of canine skin is needed to detect chemical burns early. Flinching or painful reaction when touched may be the only sign. Areas may be moist from fluid leak. More noticeable skin damage may not become apparent for hours to days.

**e. Decontamination**

1. Military – wipe with M291 Skin Decontamination Kit (SDK) Pads (not around eyes, can damage)
2. Flush dermal wounds with copious amounts of soap and water; alkaline soap if possible
3. Flush eyes copiously– saline, water
4. Technical decontamination with 0.5% sodium hypochlorite (1:10 bleach) 2-5 minutes, then rinse well

**f. Antidote for Lewisite**

1. *British Anti-Lewisite (BAL) ointment*
2. *British Anti-Lewisite (BAL) Injectable* is also known as dimercaprol (used to treat arsenic and lead poisoning) @ 2.5-5.0 (up to 7 mg/kg for severe cases) mg/kg IM every 4 hours for 2 days, then every 12 hours for the next 10 days
3. *Edetate calcium disodium (CaEDTA)*, a heavy metal chelators, may be used if BAL not immediately available; 1% solution (10 mg/ml) in NS or D5W @ 27.5 mg/kg SC q 6 hours for 5 days, wait 5 days, repeat if needed

**g. Treatments**

1. Alkaline solutions (sodium bicarbonate, calcium carbonate ) will hydrolyze CX
2. Antibiotics (cefazolin/Keflex, ciprofloxacin/Baytril)
3. Analgesics (narcotics, NSAIDs)
4. Fluorescein cornea, treat as indicated
5. Wound treatments – clip hair, topical antibiotic, silver sulfadiazine, protective bandages (wet-to-dry or non-adherent)
6. Anti-emetics if vomiting (chlorpromazine, ondansetron (Zofran), dolasetron (Anzemet), maropitant citrate (Cerenia)
7. Clear airway of fluid, provide oxygen
8. Secure airway, ventilate, 80-100% oxygen for at least 30 minutes
9. IV access for cardiovascular and respiratory support
10. Monitoring, blood collection and monitor electrolytes, acid-base

**3. Choking/Pulmonary Agents; Incendiary Agents, Irritant Gases**

- a. Choking Agents are gases or volatile liquids that dissipate rapidly. Their main effects are to the respiratory system via inhalation. Skin contact with concentrated material may cause chemical burns, but is not absorbed. These include Chlorine (CL), Phosgene (CG), Diphosgene (DP), Chloropicrin (PS), and Ammonia.
- b. Incendiary Agents cause deep burns, This includes White Phosphorous (WP)
- c. Irritant gases (riot agents) have little effect on canines. These include bromobenzyl cyanide (CA), chloroacetophenone (CN), O-chlorobenzylidene malononitrile (OC)

**a. Physiology**

1. *Choking agents* are irritating to the respiratory tract. Irritation from contact with respiratory tract mucosa causes fluid secretion. If the lung parenchyma is affected, alveolar sacs fill with fluid (pulmonary edema) and oxygen transfer from lungs to bloodstream is compromised. This is sometimes referred to as ‘dry land drowning’.
2. *Incendiary agent White Phosphorous* smoke is generally not toxic. It burns spontaneously when exposed to air; oxygen must be eliminated to stop the burning.
3. *Riot Agents* harshest effect is if they contact the eyes, causing severe irritation.

**b. Sensitivity with respect to humans**

- CN, CS, OC: quite insensitive to these (riot control agents)

**c. Prevention**

1. Respiratory protection, unavailable to working search canines, is the best protection against inhalation
2. Eye protection goggles
3. Locating upwind

**d. Symptoms**

1. Chlorine, Phosgene, Ammonia  
Coughing, choking, lacrimation (tearing), foamy saliva, nausea, vomiting, dizziness, syncope, faint, skin irritation, hypoxia, cyanosis, burning eyes, nose, mouth, throat, lower respiratory tract
2. White Phosphorous  
Particles cause severe burns on contact; smoke not as harmful.
3. Riot Agents  
Severe eye irritation

**e. Decontamination**

1. Move animal from contaminated area immediately; fresh air
2. Flush eyes, nose, mouth with water/saline, ophthalmic if available
3. Flush wounds with copious amounts of water
4. *White Phosphorus* – eliminate exposure to oxygen by submerging area in water or covering affected area with water-soaked dressing
5. *White Phosphorous* – bathe in bicarbonate solution, neutralizes phosphoric acid which becomes visible for removal as luminescent spots in the dark
6. *Irritant gases (Riot Agents)* -0.25% Sodium Sulfite more effective than saline/water to dissolve and neutralize irritant

## f. Treatments

1. Rest, minimal activity; extreme exertion is dangerous especially if respiratory signs (pulmonary edema)
2. Fluorescein cornea for damage; ophthalmic antibiotic ointment (no ulcer- steroid)
3. Flush wounds with copious amounts of water, treat based on severity (clip hair, antibacterial ointment/silver sulfadiazine, bandaging wet-to-dry or non-adherent)
4. **White phosphorous** – local ophthalmic anesthetic to remove all particles adhered to cornea before staining and topical treatments (Abs, atropine)
5. **White Phosphorous** - burn wound debridement ASAP so particles do not remain to be absorbed later
6. Antibiotics (cefazolin/Keflex, ciprofloxacin/Baytril)
7. Analgesics (narcotics, NSAIDs)
8. Consider anti-emetics if vomiting (chlorpromazine, ondansetron (Zofran), dolasetron (Anzemet), maropitant citrate (Cerenia)
9. Clear airway of fluid, provide oxygen
10. Secure airway, ventilate if necessary, 80-100% O<sub>2</sub> at least 30 minutes
11. IV access for cardiovascular and respiratory support
12. Monitoring, blood collection and monitor electrolytes, acid-base
13. Bronchodilator (terbutaline, albuterol, aminophylline, metaproterenol)
14. Diuretic therapy (furosemide, mannitol)? Non-cardiogenic pulmonary edema from damaged alveolar-pulmonary membranes

## 4. Blood Agents - Asphyxiants

These agents interfere with oxygen transport and/or utilization by displacing oxygen from ambient atmosphere, decreasing oxygen available to the lungs.

They include Carbon Monoxide (CO), Hydrogen Cyanide (AC), Cyanogen Chloride (CK), Hydrogen sulfide, and Halogens

### a. Physiology

1. **Carbon Monoxide** – affinity for hemoglobin is 240 times that of oxygen, replacing O<sub>2</sub> on heme portion of red blood cell to form carboxyhemoglobin
2. **Hydrogen Cyanide** – inactivates cytochrome oxidase system by irreversibly combining to ferric ion of cytochrome oxidase; blood becomes oxygenated but cells blocked from using it, turn to anaerobic metabolism
3. **Hydrogen Sulfide** – binds to mitochondrial cytochrome oxidase, blocking electron transport and causing cellular asphyxia
4. **Halogens** – chlorine generates to hydrochloric acid and oxygen free radicals; bromine causes direct injury effect to mucous membranes, fluorine causes cardiac toxicity and asphyxiation by saturating room air (as chlorofluorocarbon).

**b. Prevention**

1. Respiratory protection, unavailable to working search canines, is the best protection against inhalation
2. Locating upwind
3. Sheltering

**c. Symptoms**

1. **Carbon Monoxide and Hydrogen Cyanide**  
Bright red mucous membranes, cherry red blood, tachypnea, dyspnea, hyperpnea, confusion, ataxia, lethargy, seizure, coma, death
2. **Hydrogen Sulfide and Halogens**  
Salivation, blepharospasm, tachypnea, pulmonary edema, pneumonitis, confusion, dizziness, nausea, vomiting, seizure, coma, respiratory arrest

**d. Decontamination**

Decontamination is via treatment regimen: oxygen therapy, positive pressure ventilation, and antidote medications

**e. Antidotes**

1. **Carbon Monoxide** – Oxyglobin, fresh blood transfusion, hyperbaric oxygen
2. **Hydrogen Cyanide** – Na thiosulfate, Na nitrite if diagnosis certain, Oxyglobin; emesis if ingested  $\leq 15$  min, gastric lavage if 15-60 min; activated charcoal
3. **Hydrogen sulfide** – Sodium nitrite
4. **Halogens:** copious irrigation of eyes and skin, corticosteroids, antibiotics; Fluorine - avoid adrenergic drugs (avoid cardiac stimulation)

**f. Treatments**

1. Move affected animal to fresh air immediately
2. Secure airway, ventilate if necessary, 80-100% oxygen at least 30 minutes
3. IV access for cardiovascular and respiratory support
4. Monitoring, blood collection and monitor electrolytes, acid-base
5. Bronchodilator and diuretic therapy as needed
6. Seizure control. Monitor temperature

5. **Incapacitating Agents - Anticholinergics**

Anticholinergic agents are similar pharmacologically to the drug atropine. It includes **3-quinuclidinyl benzylate (BZ)**

**a. Physiology**

1. Competitively antagonize the neurotransmitter acetylcholine (ACh) at postganglionic parasympathetic (cholinergic) nerve fibers
2. Targets smooth muscles influenced by acetylcholine but lack innervation
3. Affects glandular secretions, intestinal motility, bronchi, cardiac rate/function

**b. Prevention**

1. Protective sheltering
2. Chemical impervious barriers on paws – butyl-rubber gloves, polyethylene bags, MRE outer bag
3. Skin Exposure Reduction Paste against Chemical Warfare Agents (SERPACWA) on non-haired areas (inner ear/pinna, axilla/arm-pit, flank/groin)

**c. Symptoms**

1. Tachycardia, hyperthermia, dry skin, dry mucous membranes, mydriasis (dilated pupil), blurred vision, odd behavior, stupor, confusion, incoordination
2. "Hot as a hare, red as a beet, dry as a bone, blind as a bat, mad as a hatter" or "Can't see, can't spit, can't pee, can't poop"
3. The 'anti-sludge': lack of salivation, lacrimation, urination, defecation, GI stress/diarrhea, emesis

**d. Decontamination**

1. Warm soapy water

**e. Antidotes**

1. *Physostigmine* @ 0.06 mg/kg IM or IV over 5 minutes
2. *Pyridostigmine* @ 0.1 mg/kg (IV, IM?) or 0.5-3.0 mg/kg PO q8-12 hours
3. *Neostigmine* @ 0.02-2.0 mg/kg IM PRN or 0.5 mg/kg PO q8-12 h

**f. Treatments**

1. Restrict activity
2. Monitor hydration; promote water intake; rehydrate Sc,IV
3. Antidotes
4. Supportive care
5. NOTE: anesthetics, sedatives, tranquilizers contraindicated; can potentiate BZ effects

## E. BIOLOGICAL AGENTS

Although canines are unlikely targets for biological terrorism (animals in our food supply chain may be targeted) they may act as carriers. Therefore purposeful exposure to a biological agent is of less concern, but a concern nonetheless. Among the 300 or so possible human pathogens that could be used for terrorist purposes, only a few have been investigated due to characteristics that make them ideal for military use. These fall in bacteria, rickettsia, virus, and toxin categories.

### ✂ Bacteria

- Anthrax (*Bacillus anthracis*) **canines are 500-1000 times more resistant**  
\*Ingestion may cause dz; prophylaxis, decon to decrease human exposure
- Typhoid (*Salmonella typhus*) **canines are naturally resistant**
- Brucellosis (*B. abortus*, *B. melitensis*, *B. suis*) **canines transmit to human**
- Plague (*Yersinia pestis*) **intermediate host for flea transmission**
- Tularemia (*Francisella tularensis*)

### ✂ Rickettsia

- Q Fever (*Coxiella burnetti*)

### ✂ Virus

- Venezuelan Equine Virus (*VEE virus*)
- Smallpox (*Variola virus*) **canines are naturally resistant**

### ✂ Toxins

- Botulinum (Botulinum toxins)
- Ricin (from castor beans)
- Staphylococcal Enterotoxin B (*Staph aureus*)

**canines susceptible  
but less sensitive**

**canines susceptible  
but less sensitive**

## Anthrax

Canines are resistant, however dermal contamination may expose humans.

Decontamination consists of soap and water. 0.5% hypochlorite solution can be used on equipment.

## F. RADIOLOGICAL AGENTS

Two radiation concerns are *exposure* and *contamination* by radioactive material:

- **Exposure** occurs by external irradiation, when all or parts of the body are exposed to penetrating radiation from an external source. This is primarily an *external* exposure, but may become *internal* through wounds or broken skin.
- **Contamination** occurs when the radioactive materials in the form of gases, liquids, or solids are released into the environment. This can result in both *external* and *internal* contamination. The concern with terrorism is the use of a Radiological Dispersal Device (RDD) or 'dirty bomb' to effect contamination.

Ionizing radiation may be less likely for a terrorist to obtain, but the possibility does exist and nuclear energy accidents are also of concern (Fukushima Daiichi Nuclear Power Plant, Japan, 03/2011). In addition, medical and industrial facilities are possible sources of radiologic contaminants. These sources could be in any community that we respond to that has been hit by a flood, mudslide or any other type of event.

Brief radiation emission review:

**☠ Alpha particles**

- ☞ Limited penetration: stopped by superficial dead skin layer, sheet of paper
- ☞ Ingestion is very dangerous
- ☞ Presence may be masked by water

**☠ Beta Particles**

- ☞ More penetration but generally travels just a few inches in the air
- ☞ Stopped by inner skin layers but also dangerous if ingested

**☠ Gamma Radiation**

- ☞ Not particulate, more like a high-energy x-ray with long range
- ☞ Significant penetration; dangerous whether external or ingested

**☠ Neutrons**

- ☞ Most immediately damaging to cells on contact, travel far in air
- ☞ Stopped by water, paraffin, or plastic

*Canines appear to be about 25%-70% more sensitive than humans to the acute effects of the same radiation exposure.* The range is due to different effects on varied body systems (skin, GIT, RBCs, WBCs, etc...) Effects are usually delayed, and specific signs and symptoms depend on many factors related to the exposure and to the victim. Treatments are similar for both species.

**TIME, DISTANCE, and SHIELDING** still the best option in a radiation hazard event!

**SOAP and WATER DECONTAMINATION**

Baby Shampoo (like Johnson's, perfume free) recommended for 2 reasons:

1. Fewer fragrances than other shampoos = decreases skin reactions
2. Contains *Trisodium EDTA*, a chelator of heavy metal ions, including various radioisotopes, removing these from hair follicles if used within 45 minutes of radioactive fallout.

**Litmus Paper Use in Canines**

Litmus paper may be used on humans to monitor the presence of an acidic or alkaline contaminant on the skin. The baseline for normal canine skin is different than for humans. Baselines may also differ from area to area, in heat versus cold, and between individual canines. Therefore this method of chemical detection is unreliable in the K9.

**G. FAMILIARIZATION and TRAINING**

Both responder humans and dogs need training: humans in setting up a decontamination station, and canines going through it. They are highly intelligent and advanced in their training (the canines), but familiarizing them with a decontamination procedure will make the real thing that much less stressful for all concerned.

## IV. DECONTAMINATION PRINCIPLES, PROCEDURES, and GOALS

### A. CANINE DECONTAMINATION BASIC REMOVAL INFORMATION

#### 1. Consult reference book if possible

- *Material Safety Data Sheet* (MSDS)
- *Emergency Response Guidebook* (ERG) U.S. Department of Transportation

#### 2. Powders (any dust, debris, known or unknown)

- Initially wipe off with a moist towel to decrease the amount to be washed
- Brushing is not recommended as this will aerosolize the contaminant and possibly further inhalation exposure

#### 3. Thick Caked On Contamination

- Break down with mechanics' hand wash products, mineral oil (especially good for petroleum-based contaminant), or scraped off with a putty knife
- Scissors with caution (lacerate canine); clippers will not work for long.

#### 4. Absorbents for liquid decontamination

- Flour, baking soda, diatomaceous earth, Fuller's earth, synthetics
- Be aware that these absorbents also present their own inhalation hazards

#### 5. Physical removal of the contaminant:

- High volume, low pressure water augmented by soap is the recommendation
- Rinse-wash-rinse cycle as much and as many times as deemed needed
- Lukewarm water and dish soap (Dawn®, Palmolive®) are common; can dilute with water to decrease suds; Prell®; baby shampoo
- **CAUTION: some Hazmats become reactive when exposed to water.** Check pages 342-347 of the 2008 ERG for a partial listing.
- Soap's high pH neutralizes many chemicals, dissolves some petroleum agents
- Go from head to tail, shoulder to forelegs, back to belly, hips to back legs

#### 6. Eyes, Ears, Nose and Mouth

- Small bottles OTC eye rinse (saline, ionized water) ideal to gently flush eyes
- If too difficult to manage (uncooperative, protective gear inhibits capability) then remove as much contaminant around eyes with non-alcohol based towelettes; further eye issues handled at medical or veterinary station
- Do not apply petroleum-based or other eye ointments which may absorb contaminant and worsen corneal damage
- Avoid getting soap into eyes, nose, and mouth. Although neutral shampoos may be safer for the cornea and mucous membranes, they are not as effective as the higher pH shampoos in neutralizing many chemical agents
- Soaps are not as harmful in ears, however a dog will shake vigorously if water gets inside their ears; we are trying to delay the inevitable shake until the end!

## 7. Special Considerations

- Alternate decontamination agents for **chemicals that worsen if exposed to water** include applying baking soda or flour to form a caked-on product, then brushed or comb out or physically remove by wiping, brushing or combing off
- Special care and attention should be directed to adequately decontaminate **the paw**; deep-crevassed pad edges can trap particles. Use a soft-bristled brush. We use a dry surgical scrub brush (BD E-Z Scrub 160 Ref 1603).
- **Eye flushing** with 0.9% saline, purified water, or tepid tap water for 15 minutes is important for blistering (mustard, Lewisite), blood and metabolic agents (arsine, cyanide)
- Bathing the canine with **0.5% hypochlorite** (bleach) followed by soap and water is recommended for blistering agents (vesicants). Dilute bleach is included in some decontamination protocols after soap and water for other hazardous materials, especially flood water deployments.
- Dermal exposure to **phenols** requires all personnel wear gloves, gowns, and masks then blot the fur and skin with paper towels before washing
- **Never use hydrocarbon-based solvents** to clean a dog! They cause their own painful damage by defatting the skin as well as increasing dermal absorption of other contaminants like polychlorinated biphenyls (PCBs)
- Do not allow canine to drink **contaminated run-off**. Basket muzzles will not prevent this, regular muzzles do not allow for decontamination of the face. Consider elevation of the wash/rinse site or providing for drainage of run-off
- Important to **clean the area around the nose and mouth** to decrease what licking will bring into the mouth, leading to ingestion exposure of contaminants. Oral exposure and subsequent ingestion increase absorption and worsen medical problems
- Remember baby shampoo within 45 min. of **radiation exposure**; if still contamination, clip the hair of only the area still hot, re-decon, and recheck.
- Be cognizant of the **weather conditions**. Consider shelters in post-decon care of set-up: fans and shade if warm/humid to avoid hyperthermia; dryer or heated protective environment to avoid hypothermia in cold climates
- Post decontamination **veterinary check** should always be included in the protocol, after decontamination; pre-decon medical treatment must be performed by a properly protected responder

## **B. HUMAN SAFETY in a DECONTAMINATION LINE**

Basic guidelines for Personal Protective Equipment (PPE) when handling animals include gloves, protective eyewear, durable clothing, and protective footwear. Each disaster presents its own health and safety risks. The safety officers, Hazmat specialists, and command staff should continuously monitor the deployment site conditions and modify the PPE as needed. Other factors, like heat stress and hypothermia, are also conditions to be considered under which the personnel are clothed as well as their time involved in operations.

Occupational Safety and Health Administration (OSHA) guidelines define the level of protection required for specific hazards. PPE is divided into 4 categories: from most to least protection they are Level A, B, C, and D. Level A is used when the greatest protection for skin, respiratory, and eye systems are needed. Level D is for nuisance contamination only. Specific courses and training are required to properly utilize Level A, B and C protective equipment. Level C would add an increased level of face mask and suit protection. Level D is similar to the protection hospital workers may use in a contamination unit.

Some PPE suggestions include:

1. Knee-length rubber boots with slip-resistant soles
2. Nitrile and polyvinyl chloride gloves offer good protection from acids and other chemicals (often in flood waters), are durable and resistant to abrasion and tearing
3. Double gloving with an outer heavy fabric glove may provide additional protection against bites and scratches
4. N-96 particulate respirators to protect against spray mists during decontamination
5. Eye protection with tight fitting goggles to protect against splash hazards (safety glasses do not protect from splashes)
6. If the hazard does not require level A or B suits, a waterproof over-garment can be used to prevent liquids from soaking through to undergarments
7. Individuals working in the human decontamination line must be attired in PPE not more than one level less than that of the individuals they are decontaminating; this should apply to canine decontamination line even though they are without PPE
8. During the EBOLA crisis, the AVMA recommended using one level above for decontamination of dogs
9. Back and knee injuries are common when working with animals; remember posture, knee pads, consider a raised platform to perform decontamination

## C. GOING THROUGH THE DECON LINE

### 1. Assessment – Emergency (Life-Threatening) or Non-Emergency

- If emergent but the contaminant is itself not life threatening, gross emergency decontamination is performed and medical attention given
- If emergent and the removal of the contaminant is itself part of the treatment, technical emergency decontamination is performed and further medical treatment given
- In a non-emergent situation, gross and/or technical decontamination is performed based on the contaminant involved

♫ *Note: handler should accompany the canine through decontamination if possible.*

- 🐾 If the handler is unable to, another experienced handler may do so
- 🐾 If a canine cannot be safely taken through without the handler, confine canine to contain contamination
- 🐾 If handler requires decontamination and no other can take canine through, confine canine until handler is clean, can don protective clothing, then take canine through
- 🐾 If handler unable to take canine through and no other can safely do it, confine canine, consult to consider options, including sedation, without getting hurt!

### 2. Preparation

- Remove all equipment and gear from the canine and place in Hazmat container until cleansed (5% hypochlorite solution, 5% Sodium carbonate for G agents, M295 IEDK wipe down mitts), deemed safe, or disposed
- Muzzle use considered to prevent licking, drinking wash water, or bite prevention; cage muzzles allow for panting, can still drink through them; may be better tolerated
- Maintain control so as not to spread contaminants to clean areas by maintaining a decontamination corridor via physical barriers

### 3. Rinse – Wash

- Initial gross decontamination water removal of bulk of contaminant, or other methods as described for water-reactive substances, powders, and thick contaminants
- Cleanse head with towelettes (around eyes, inner ears, nose, mouth)
- Option to rinse eyes with eye rinse (saline, purified water) but in reality this is often difficult with all the PPE the humans wear
- Wash and rinse as many times as needed, from top of back to tail and down body and legs
- Special attention to paw pads and don't neglect under the tail

## About Soaps

- Dish wash soaps common (Dawn®, Palmolive®), very sudsy and requires a lot of rinse water. Consider diluting with water before use to decrease suds
- Hair shampoo Prell® suggested as less sudsy
- These products are slightly acidic, and may assist in neutralizing alkaline contaminants
- Baby shampoo is neutral, less irritating if splashes into eyes, and has been shown to remove petroleum contamination and chelate radiation heavy metal ions when used properly (within 45 minutes of exposure)
- Human soaps dry out canine skin with repeated use, compromising oils that protect the skin; when they scratch dogs can break the skin and ‘hot spots’ (superficial dermatitis) is a risk (Oso, WA Landslide occurrence)
- Consider intermittent use of dog shampoo, formulated to be less harsh on their skin (aloe and oatmeal based)

## 4. Drying

- After the inevitable K9 shake-off of water, allow air drying with attention to the weather conditions (shelter if cold/windy)
- Option to dry with towels or an air dryer
- Canine now should be next to or within the designated ‘cold zone’

## 5. Antimicrobial Station Option

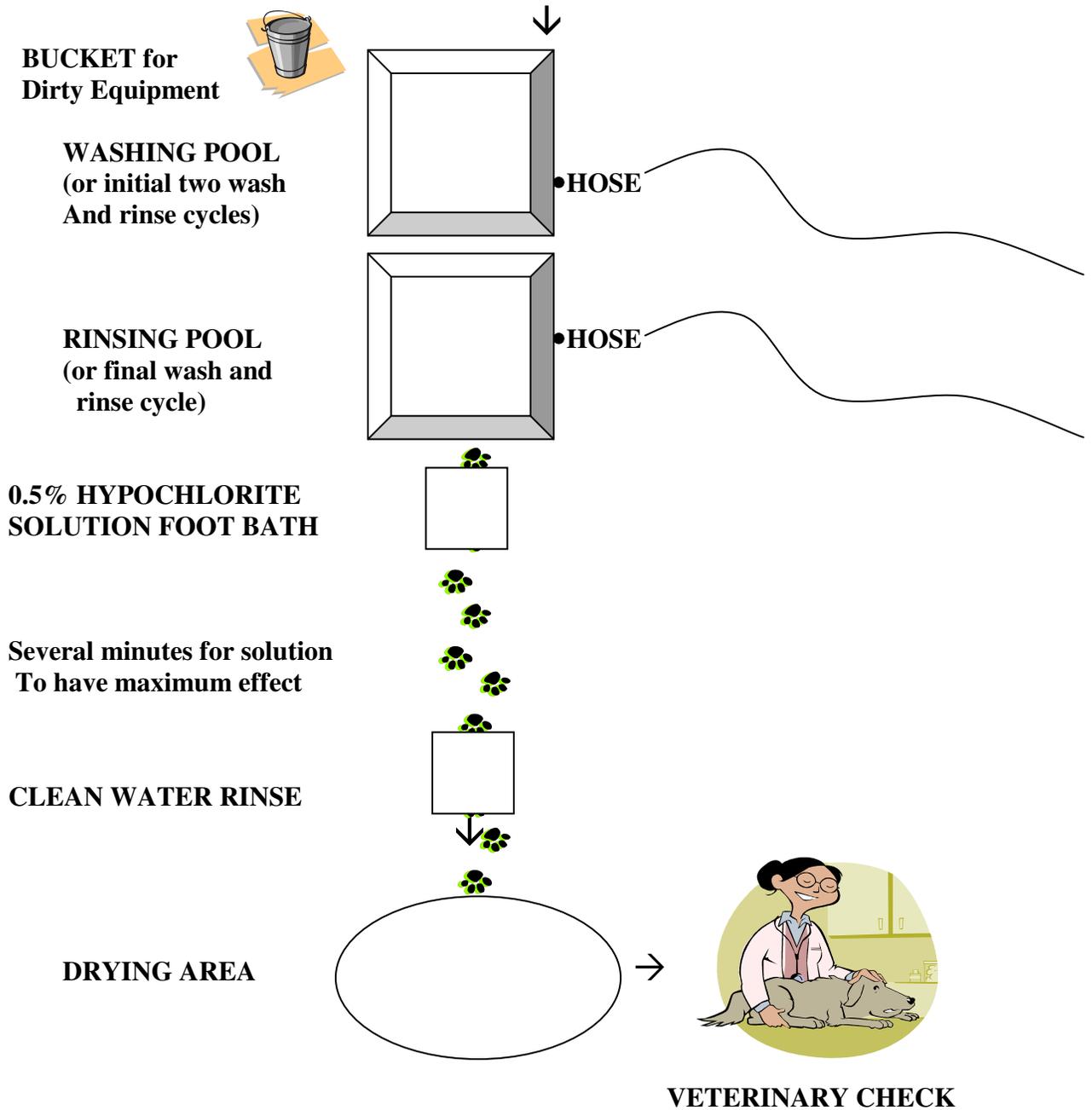
Spray on solution or walk canine through a diluted bath if biological contamination suspected. There are several options, each with their own spectrum of activity, advantages and disadvantages.

- *Hypochlorite* (bleach) 0.5% (household bleach diluted 1:10); rinse off once done (ranges of 15-60 min); 100-500 ppm may be used on equipment
- *Biguanide* (chlorhexidine) 0.05-4%
- *Quaternary ammonium* 400 ppm, 0.1-2%
- *Iodophore* (povidone-iodine) 100ppm
- *Peroxygen* 20 g/L or 1%
- *Alcohol* (ethyl, isopropyl) 70%
- *Chlorine dioxide?* (oxidizer, ICA Tri Nova)

## 6. Monitor, Treat, Return to Service

- Monitor for contamination, including radioactive checks when dry
- Special attention to eyes, ears, nose, throat, paws, and under the tail
- Repeat decontamination if necessary, new collar/leash, continue to medical
- Complete medical/veterinary evaluation and treatment as needed
- Return to service

## D. DECONTAMINATION CORRIDOR



## E. EXPOSURE PRINCIPLES

### 1. Chemical Exposure

#### Remove

- ☒ Relocate to a well-ventilated upwind area
- ☒ Remove, replace all gear with metal or nylon disposable items
- ☒ Remove liquid contaminant by pinching or blotting (do not rub, as this spreads the contaminant)
- ☒ Wet down if contaminant is dry/powder (brush may aerosolize) then brush coat to remove most of it

#### Wash

- ☒ High-volume, low-pressure lukewarm water, soap if available
- ☒ Do not delay if warm water or soap is not available
- ☒ Special attention to paws and pads that can trap material in crevices

#### Monitor

- ☒ Immediate medical evaluation, veterinary if available
- ☒ Continued monitoring for changes in health status
- ☒ Recheck and monitor for contamination

### Concerning Petroleum-Based Contaminants

July 2007 the Massachusetts Task Force 1 conducted a canine decontamination drill to test their ability to remove a petroleum-based contaminant from the search canines. The contamination test product was Glo-Germ®, a non-toxic product used to test efficiency of hand-washing in pre-school children. It is not visible in regular light but shines bright orange under a black light.

The handler and two other team members were placed in a level B suit to give them the experience of having to don this level of personal protection, as well as get the dogs used to interacting with people in a suit.

After paw contamination was confirmed using black light, soap and water decontamination was performed. Paws rechecked under black light illumination still had test product contamination.

It was then suggested that since the contaminant was oil based, perhaps dissolving it in some mineral oil would help break it up before applying the detergent. The theory is that *like dissolves like*. So a bottle of mineral was used at the beginning of the decontamination corridor.

When the paws were checked under the black light for level of decontamination, no grossly visible evidence remained of the Glo-Germ®.

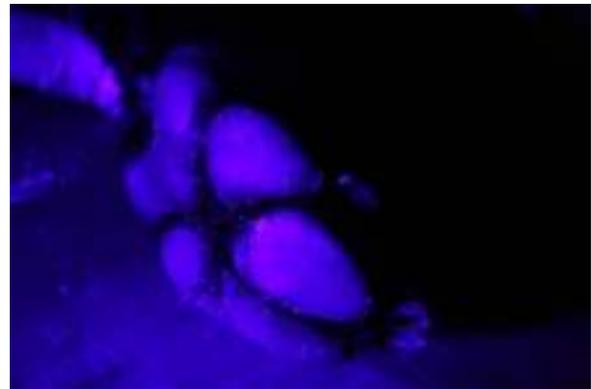
Conclusion: *for an oil-based contaminant, pre-treatment with mineral oil may significantly increase the efficiency of the decontamination.*



Confirmation of contamination



Still contaminated after soap & water



No contamination with miner oil  
spray before soap & water

## 2. Biological Exposure

This may go unnoticed until victims develop symptoms and seek medical attention. Though dogs are resistant to many agents labeled as terrorist threats, they are potential transmission vectors. Decontamination is essential if exposure to a particulate, liquid or aerosol bio agent has occurred within the past several hours. Decontamination may not help but won't hurt if exposure is not discovered for several days.

### Remove

- ⊗ Relocate to a well-ventilated upwind and upgrade area
- ⊗ Remove, replace all gear with metal or nylon disposable items
- ⊗ If agent is in powder form, wet down the canine to prevent it from aerosolizing and being breathed in by them or anyone else
- ⊗ Remove visible dust or solid with a brush, pinch or blot liquid contamination (don't wipe as this just spreads it around)

## **Wash**

- ⊗ High-volume, low-pressure lukewarm water, soap if available
- ⊗ Do not delay if warm water or soap is not available
- ⊗ Special attention to paws and pads that can trap material in crevices

## **Monitor**

- ⊗ Dry the canine and monitor both the dogs and yourself for health changes
- ⊗ Monitoring by Hazmat
- ⊗ Veterinary examination and rechecks, possibly long term

### **3. Radiological Exposure**

Radioactive materials may not cause immediate signs of exposure. Detectors are the most sensitive indicators of exposure. Due to the threat of terrorists using a dirty bomb, any explosion should be assumed a radiological hazard until determined otherwise.

Contamination can be picked up on the canine's coat and paws. Decontamination is critical to prevent further spread, limit absorption (beta and gamma), and remove a source for further inhalation or ingestion of the hazard. Decontamination is similar to other hazard removal.

## **Remove**

- ☞ Relocate to a well-ventilated upwind and upgrade area
- ☞ Remove, replace all gear with metal or nylon disposable items
- ☞ If in dust or powder form, wet down so as not to aerosolize agent into canine's breathing zone

## **Wash**

- ☞ High-volume, low-pressure lukewarm water, soap (baby shampoo) if available
- ☞ Do not delay if warm water or soap is not available
- ☞ Special attention to paws and pads that can trap material in crevices

## **Monitor**

- ☞ Alpha radiation is masked by water, so thoroughly cleanse and rinse the canine and be checked for radiation once dried off
- ☞ Medical examination
- ☞ Hazmat and medical monitoring



**If radiation detected after multiple decontamination, consider clipping hair from only contaminated spot(s), decontaminate again, and recheck. Full body clipping is impractical, and potentially will worsen the situation with irritation and wounds in thin-skinned areas.**

## V. DECONTAMINATION SYSTEM-DESIGNS

### A. GROSS and TECHNICAL DECONTAMINATION – Human System

In August 2005 a full set-up of the CBRNE decontamination unit was performed and included was a canine decontamination run. The handler wore a Lakeland Industries Level B Tychem<sup>®</sup> 9400 suit, went through a Reeves gross decontamination shower, and then through an IRT Tent (from Immediate Response Technologies) decontamination shelter. No test contamination material was used. Concerns with the process of sending a canine through these specific team equipment units were addressed.

#### Stage 1: Gross Decontamination

This is a shower designed to remove any visible or non-visible contaminant from the person or canine. By decreasing the gross amount of CBRNE or Hazmat contaminant, the thorough shampooing stage can be much more effective.



- The handler will be the main person to decontaminate their canine in most situations unless they are incapacitated.
- Should the canine become difficult to handle, options discussed:
  - Giving an intramuscular injection of midazolam. Valium is not ideal, as it is poorly absorbed IM and stings. Medazolam is a better option.
  - Safety cage muzzle (like the track dogs) that will not interfere with panting or impinge on the muzzle area, and protects others from being bitten
  - Nylon muzzle that will prevent the canine from drinking contaminated water or licking contaminated fur
- Enter the gross decontamination water shower after initial blotting (don't rub) of any visible liquid or powder with a wet paper towel. Stay for as long as it takes to remove as much visible contaminant as possible, or as long as is deemed appropriate by Hazmat and medical personnel based on the suspected contaminant, especially if it is not visible.
- Replace collar and leash with clean ones provided between here and next stage.

## Stage 2: Technical (Thorough) Decontamination

This is a shower area designed to further decontaminate personnel to a point at which they can remove all contaminated clothing, proceeding further to a personal enclosed shower if necessary. For the canines, it is decontamination to a point at which they are safe from further skin contaminant effects and safe for others to be around or handle.

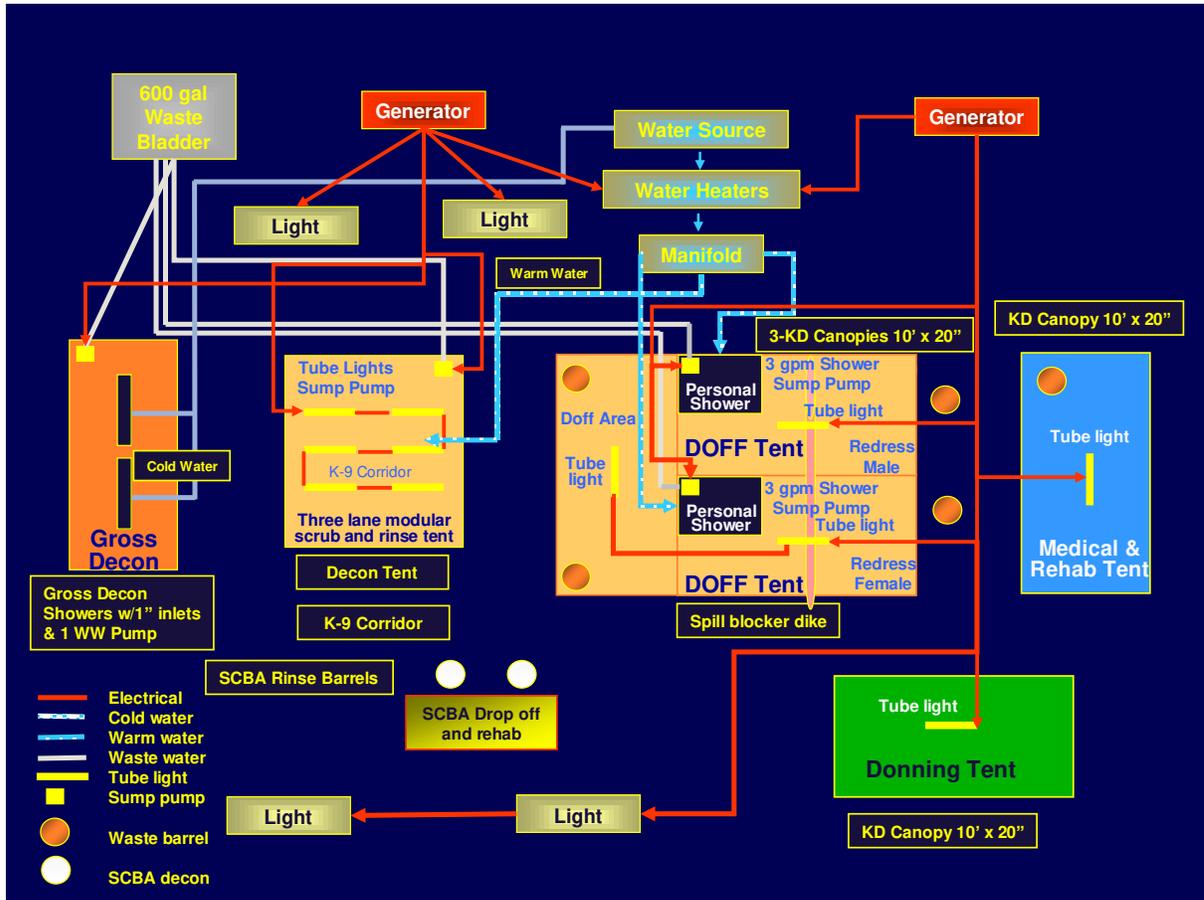


- Enter the area and decontaminate the handler first, who should try to avoid dripping potentially hazardous run-off from their body onto the canine, then they can decontaminate their canine
- If there is more than one helper in this area, one can do the handler and another begin shampooing the canine.
  - This decreases time spent in decontamination, important if medical attention needed or if the cold water may cause/add to hypothermia
  - Have 2 hoses with spray nozzles for each helper to use on the handler and canine, or one for a helper to use on the handler and one for the handler to use on their canine
- In an IRT Decontamination Tent, you may need to take down one hanging wall to widen the area to accommodate both handler, canine, and a helper(s)



## DECONTAMINATION FLOOR PLAN

1. Canine decontamination corridor
  - a. Stands alone (MA TF-1 K9 Decontamination System)
  - b. Corridor goes from hot to warm to cold zone
  - c. Adaptable level of decontamination based on contaminant
  
2. Gross and technical decontamination with a canine decontamination corridor within the 3-lane modular scrub and rinse tent



## B. CANINE DECONTAMINATION SYSTEM

The Massachusetts Task Force 1 Urban Search and Rescue team has been working towards an efficient, compact, affordable canine decontamination station that is simple to set up and adopts Hazmat guidelines with respect to handling contaminated run-off.

The complete set-up consists of the following items (2010 pricing):

🐾 IRT <a href="http://www.imresponse.com">www.imresponse.com</a>	2 IRT Hazmat Basins@ \$400 ea	\$800
🐾 Home Depot	4 plastic shelving units	\$ 70
🐾 Home Depot/Lowes	Sump pump for waste removal	\$ 70
🐾 Dri Dek: <a href="http://www.dri-dek.com">www.dri-dek.com</a>	12 Dri-Deck 12"x12" panels	\$ 60
🐾 Local hardware store	2 lengths of rope	\$ 5
🐾 Local hardware store	Plastic cable ties	\$ 5
🐾 Local hardware store	1 plastic sheet	\$ 10
🐾 Local hardware store	2 Hoses	\$ 20
	Wash Hose & Wand	\$ 25



This is one of two shelving units before modification.



IRT Hazmat Basins. Ports are visible at the bottom along the far



Six 12"x12" DriDek® panels were connected and their corners cut to accommodate the shelving poles. The edge connectors were trimmed to create a smooth edge.



Cable ties are used to secure the flooring to the shelf. This is to prevent the floor from slipping during the decontamination procedure.



This is one of the modified assembled shelf units.



Hole was drilled at the top end of the poles that are to function as a railing; presents a flimsy but respected border along corridor so they don't jump off



The IRT Hazmat Basins are compact, light-weight, durable, and easily assembled.



Assembled shelving units are placed within the two pools: one for the initial soap decontamination, next for water rinsing. A plastic sheet has been placed between the two pools to prevent contaminated water from falling through.



After decontamination, the canine goes off the set up to an area dedicated to drying. If deemed necessary, a basin filled with 1-2 inches of 0.5% hypochlorite solution (1:10 diluted household bleach) followed by a basin filled with clean water can be set up for the canine to walk through. Veterinary check is recommended.

### **ADVANTAGES of THIS SYSTEM**

1. Inexpensive
  - a. In 2007 the total cost was just over \$1000 for the entire assembled unit
  - b. This includes all the added flooring, ropes, plastic sheeting and cable ties
2. Light weight
  - a. Total weight measured 47 pounds (21 kg): shelving assembly weighed 35 pounds (16 kg), each pool weighed 6 pounds (2.5 kg)
3. Compact, taking up minimal storage space when packed
  - a. Shelving assembly measured 2' x 3' x 1.5'; each pool measured 4' x 10'
4. Durable
  - a. The units held up under several canine decontamination drills
  - b. Field testing required
5. Easy to Assemble
  - a. The entire unit took 15 minutes the first time, 10 minutes the second time
  - b. Familiarity of the team personnel achieved with our yearly drills
6. Containment of run-off
  - a. Hose attachments in the pools allow contamination containment
7. Reusable, and inexpensive to replace parts
8. Easy on the decontamination personnel
  - a. Back injuries and strains have been identified as a major occupational hazard when working with animals
  - b. Elevation of the working surface puts minimal strain on personnel backs
9. Promotes better decontamination of the canines
  - a. Elevation puts canine at a better level to perform a better decontamination, especially paws and foot pads that require special attention
10. Prevents canines from drinking contaminated water
  - a. During a drill in hot weather where the canine was standing in a plastic pool, he drank some of the wash water before it was caught by the handler
11. Protects PPE suits from damage
  - a. Personnel do not kneel on the ground to perform the decontamination

### C. FIELD TEST

On December 28 and 29, 2007 local and state resources were used in efforts to locate human remains in a pile of debris from a fire.



Human Remains Detection (HRD) certified canines were used to narrow the search and they successfully located human remains.



Hazards included asbestos as well as human body parts

- 🐕 Asbestos presented an inhalation hazard for the canines
- 🐕 Also it is a digestion hazard due to the licking habits of dogs



Our decontamination system design was assembled within a tent with a warm air ventilation port in use. Water was also heated with a diesel-powered unit



- 🐾 One railing pole broke at its base and was duck-taped back; one shelf cracked
  - Replace posts with stronger pole (PVC pipe)?
  - Consider stainless steel shelving (heavier but more durable)
- 🐾 One of the state trooper German Shepherds was wobbling on the scaffolding
  - Lash the 2 shelving units together? Sandbag the base of the units?
- 🐾 Some canines were not our US&R team dogs
  - Did very well despite never having been trained on the units



## D. Low-Water Commercial System

1. **Anivac** is a self-contained 'dry-vac' system for animals
  - a. Sends water through adjustable nozzles deep into hair coat directly to skin
  - b. Adjacent to the nozzles are the suction unit to take away the 'dirty' water
  - c. Contaminated water is released into self-contained pan within the unit
  - d. Design overcomes natural resistance of animal hair to the penetration of moisture; spray action washes the skin of the animal first, pushing the dirt up and into the vacuum force of the wand, and then washes the animals coat as the solution is being vacuumed up by the wand.
  - e. The vacuuming action pulls majority of water from coat, leaving the animal only damp to the touch.
  - f. Uses 90% less water than regular bathing



### 2. Accelerated Hydrogen Peroxide

- a. **AHP** (Accelerated Hydrogen Peroxide) is a synergistic blend of commonly used, safe ingredients that when combined with low levels of hydrogen peroxide produce a potent germicide and cleaner.
- b. In-use dilution of AHP for bathing the active ingredient is less than 0.1% as opposed to 3% available in stores
- c. Non-irritating to eyes and skin, free of Volatile Organic Compounds (VOC's), no toxic ingredients, no residual
- d. Efficacy: AHP is EPA approved for killing both enveloped and non-enveloped viruses as well as bacteria (including mycobacteria such as Tuberculosis)
- e. Speed: existing disinfectants generally take 10 minutes to kill - since surfaces dry quicker than that the product must be reapplied in order to ensure sufficient contact time. In Canada AHP products are approved with a 5 minute kill time. This quicker kill time better assures an effective end result and greatly lessens the chance that reapplication will be needed.
- f. Personnel safety: AHP converts to water vapor and oxygen when drying and in it's in use form does not require personnel protective equipment.
- g. Environmental: AHP is Volatile Organic Compound (VOC) and Nonylphenol Ethoxylates (NPE) free. While drying it converts to water vapor and oxygen



### 3. Advantages

- a. Minimal water required (2 liters per medium size dog)
- b. Accelerated oxygen for biological decontamination
- c. H<sub>2</sub>O<sub>2</sub> solution 3 minutes to sanitize, 5 minutes to disinfect
- d. Small, portable, light weight (small unit - 32 lbs.)

### 4. Disadvantages

- a. Requires power source
- b. Vacuum noise
- c. Approved for use on equipment; animal use approval?



## VI. CANINE DECONTAMINATION KIT

### A. Equipment – General

1. Box container
  - We chose to pack the K9 decontamination kit smaller items in one box. Hazmat has this box in their cache section.
  - The larger items (pools and shelving) are separate but kept in the same area.
2. Waterproof tarp
  - 1-2 of these are laid on the ground, and the decontamination set-up (pools and shelving) are placed on top.
3. Sealable industrial strength plastic bags
  - These are used to contain contaminated items
  - Either this or a length of heavy plastic sheeting is placed over where the 2 pools meet to prevent contaminated water from leaking between the pools
4. Hose
5. Spray nozzle or wand
  - Allows for water to be better directed underneath the canine (belly wash)
  - An adjustable water flow
6. Buckets
  - Used to throw in the contaminated collars, leashes, and used brushes until they can be collected in bags for disposal
  - Also can be used to decontaminate metal items that will be reused
7. Water heater (separately stored item)
  - To prevent hypothermia in a cold weather deployment
  - A tent or other environment that can be warmed and provides wind protection is needed as after water decontamination while canines dry off
  - If not available, consider a groomers drying unit to quickly dry the canine
8. Pools – 2 (separately stored item)
  - A CBRNE or Hazmat decontamination model uses two separate areas: one for wash station and another for the rinse station
  - We like the IRT Hazmat Basins ([www.imresponse.com](http://www.imresponse.com)) that have a hose connection to divert contaminated water away, are easily set up and fold down to a small unit for storage
9. Elevated Shelving
  - Advantages include keeping the canine out of contaminated water, preventing them from drinking that water, easier to decontamination properly (especially under the belly and the paws), easier on your back, and easy to assemble
  - We used plastic shelving from Home Depot that was inexpensive, light-weight, and easily assembled but will probably not stand up to more than one 2 week deployment
10. Shallow Pan or Box
  - If a biologic hazard is suspected, walk the canine through a foot bath of dilute Clorox solution (0.5% sodium hypochlorite made by 1:10 dilution in water)

## **B. Equipment – Human PPE**

1. Eye protection
  - 4-8 pairs of goggles if needed to protect from contaminated water spray
  - The canines will inevitably shake themselves at some point as well
2. Gloves – 2 boxes
  - Latex or all non-latex to cover latex allergies, these often tear with much use
  - A heavier over-glove if needed for protection from more hazardous materials
3. Masks
  - Situation-appropriate issue
4. Tyvek Suits or situation-appropriate issue protective suit

## **C. Decontamination Supplies**

1. Mineral Oil – 1-2 bottles
  - We put this in spray bottles for easy application to areas of petroleum-based contamination (usually on the paws and in between the toes)
  - The adage ‘like dissolves like’ is the basis for using this oil to break up the contaminant, then applying a shampoo or soap to remove it from paws or hair
2. Spray bottles – 2, for mineral oil application
3. Ophthalmic (Eye) Rinse – 4 bottles
  - This is used if there are clear signs of eye irritation or contamination, otherwise it is left for the post-decontamination medical check to use if needed
  - There are over-the-counter saline and purified water solutions
4. Liquid soap
  - Dish detergents (Dawn® or Palmolive®) traditionally used in animal decontamination; baby shampoo (Johnsons® perfume-free) for radiation
  - For a low suds alternative dilute the above 50:50 with water or use Joy® or Prell® products. These work just as well with a thorough scrub
5. Dog shampoo
  - After several soap washes, the oil-based protection on their skin is gone and the coat becomes dull
  - This will help re-establish the coat after several soap shampoos
6. Surgical scrub brushes
  - Not harsh, stiff enough to work; we found surgical scrub brushes work well
  - The BD E-Z Scrub 160 Ref 1603 (2 boxes, 30/box) have a plastic bristle side and a sponge side
7. Absorbent material
  - Baking soda or cornstarch are typically used to absorb a liquid contaminant and then be wiped off
  - Other: diatomaceous earth, Fuller's earth, soil, activated charcoal, synthetics
  - This decreases the contaminant burden that must then be removed

8. Moist towelettes
  - They can be used to wipe sensitive areas around the eyes, nose, mouth, and inner ears as well as prepuce and vulva where soaps can be very irritating
  - These can be used to wipe off powder contaminants before they aerosolize, as brushing may put powders into the air and further contaminate personnel
  - Large absorbent towels - for drying canine after decontamination

#### **D. Canine Supplies**

1. Dog dryer or shelter from cold
  - In addition to warm water, a heated shelter area is good to continue the drying process during cold weather
  - A groomers dryer will hasten the drying process, but a warm protected environment will be fine along with monitoring the canine for signs of hypothermia (temperature check is the easiest!)
2. Emergency Blankets
  - Protection if wet in a cold environment
3. Scissors
  - Bandage scissors are preferred as they have a blunted tip that won't cut the skin when taking off bandages
  - Never shave or use clippers to remove hair to skin level, as this may cause abrasions and worsen contamination
4. Muzzles
  - 6 cage muzzles, 2 each various sizes
  - We use basket muzzles so the canines can still pant if needed as well as receive some water decontamination through the muzzle
  - Intended use is for known aggressive canines, or questionable situations when the handler is not present and another handler unavailable
  - Aggressive canines that cannot be muzzled may need to be contained in an area (tied in a safe spot or kenneled) until qualified personnel can help handle them for decontamination
5. Leashes
  - Disposable leashes can be used as a collar and leash combination to replace contaminated leashes and collars that must be removed



## ADDENDUM

During the SR-530 Oso, Washington Landslide deployment the Washington State National Guard provided decontamination for both human and canine first responders in their mass Decontamination Units.

- Sheltered
- Warm water
- Liquid dish detergent
- Towels

The detergent caused loss of the natural oils that help protect the dogs' skin from wet and cold within 2-3 days. Their sebaceous glands could not replenish their natural oils fast enough. Their skin was so dry and itchy the dogs scratched wounds into their skin. Dog shampoo, oatmeal-based, was purchased for the remainder of the deployment.



## REFERENCES

1. Clementi C, Weapons of Mass Destruction Terrorist Agents. *ASPCA Animal Poison Control Center*
2. Department of the Army, Headquarters. *Veterinary Service: Tactics, techniques, and Procedures*. Field manual No. 4-02.18. Pages 5-7 to 5-23. December 2004.
3. *Department of Defense Military Working Dog Veterinary Service. The handbook of Veterinary Care and Management of the Military Working Dog*. March 2004; Page 104.
4. Department of Homeland Security. Standardized Decontamination Procedures. *Urban Search and Rescue Weapons of Mass Destruction Enhanced Operations*. SM4-1 to 4-17.
5. Eifried, Gary. *Weapons of Mass Destruction and Hazardous Materials; Protection, Decontamination, and Medical Aid for K-9 Teams*. EAI Corporation 2006.
6. Fox, PR. Assessment of acute injuries, exposure to environmental toxins, and five-year health surveillance of New York Police Department working dogs following the September 11, 2001, World Trade Center attack; *JAVMA*, Vol 233, No. 1, July 1, 2008 Pages 48-59
7. Gordon LE. Recommendations for Canine Technical Decontamination. [www.usarveterinarygroup.org](http://www.usarveterinarygroup.org) August 2005.
8. Gordon LE. Canine Emergency and Gross Decontamination Procedures. [www.usarveterinarygroup.org](http://www.usarveterinarygroup.org) April 2006.
9. Gordon LE. Massachusetts Task Force 1 Canine Decontamination Station. [www.usarveterinarygroup.org](http://www.usarveterinarygroup.org) December 2007
10. Gwaltney-Brant SM, Murphy LA, Wismer TA, Albretsen JC. General toxicologic hazards and risks for search-and-rescue dogs responding to urban disasters. *J Am Vet Med Assoc* 2003; 222:292-295.
11. Hachey, Dave, President Anivac Corporation. [www.AnivacFirst.com](http://www.AnivacFirst.com).
12. Murphy LA, Gwaltney-Brant SM, Albretsen JC, Wismer TA. Toxicologic agents of concern for search-and-rescue dogs responding to urban disasters. *J Am Vet Med Assoc* 2003; 222:296-304.

13. Otto CM, Downend AB, Serpell JA, Ziemer LS, Daunders M. Medical and behavioral surveillance of dogs deployed to the World Trade Center and the Pentagon from October 2001 to June 2002. *J Am Vet Med Assoc* 2004; 225:861-867.
14. Otto CM, Franz MA, Kellogg B, Lewis R, Murphy L, Lauber G. Field Treatment of search dogs: lessons learned from the World Trade Center disaster. *J Vet Emerg Crit Care* 2002; 12(1):33-42.
15. Slensky KA, Drobatz KJ, Downend AB, Otto CM. Deployment morbidity among search-and-rescue dogs used after the September 11,2001, terrorist attacks. *J Am Vet Med Assoc* 2004; 225:868-873.
16. Soric S, Belanger MP, Wittnich C. A method for decontamination of animal involved in floodwater disasters. *J Am Vet Med Assoc* 2008; 232:364-370.
17. Wenzel JG. Awareness-level information for veterinarians on control zones, personal protective equipment, and decontamination. *J Am Vet Med Assoc* 2007; 231:48-51.
18. Wingfield W, Nash S, Palmer S, Upp J: *Veterinary Disaster Medicine*; Wiley-Blackwell; 2009
19. Wingfield W, Palmer S,: *Veterinary Disaster Response*; Wiley-Blackwell; 2009
20. Wismer TA, Murphy LA, Gwaltney-Brant SM, Albretsen JC. Management and prevention of toxicosis in search-and-rescue dogs responding to urban disasters. *J Am Vet Med Assoc* 2003; 222:305-310
21. Dr. Igor Shepherd, personal communication 1-23-2020; the use of Johnson's perfume-free baby shampoo for radiation decontamination