

# Field treatment of search dogs: lessons learned from the World Trade Center disaster

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## Abstract

**Objective:** To provide a synthesis of information learned by the veterinary community during the care and treatment of search and rescue dogs in a large-scale urban disaster.

**Summary:** Disaster medicine requires several stages. The most important stage is the planning stage. To function effectively and safely in a disaster situation, a disaster response plan and prior training in disaster response are essential. The execution of a disaster plan requires coordination and communication with multiple agencies. Treatment of search and rescue dogs involves front line field care for life-threatening emergencies, a first aid station or MASH unit in close proximity to the disaster and/or base of operations for stabilization and general medical care, and local full service veterinary hospitals for specialty and extended care.

**New or Unique information provided:** This report is a summary of experiences gained in preparing for and implementing veterinary care in a major disaster. Medical conditions that affected search and rescue dogs and were treated by veterinary disaster responders at the World Trade Center are presented.

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## Introduction

Disaster medicine has been a limited scope of veterinary medicine until recently. The focus has been predominantly on naturally occurring disasters, such as floods, earthquakes, fires and hurricanes. These types of disasters can have far reaching effects on humans and animals. The veterinary efforts in natural disasters have functioned primarily to address the needs of companion

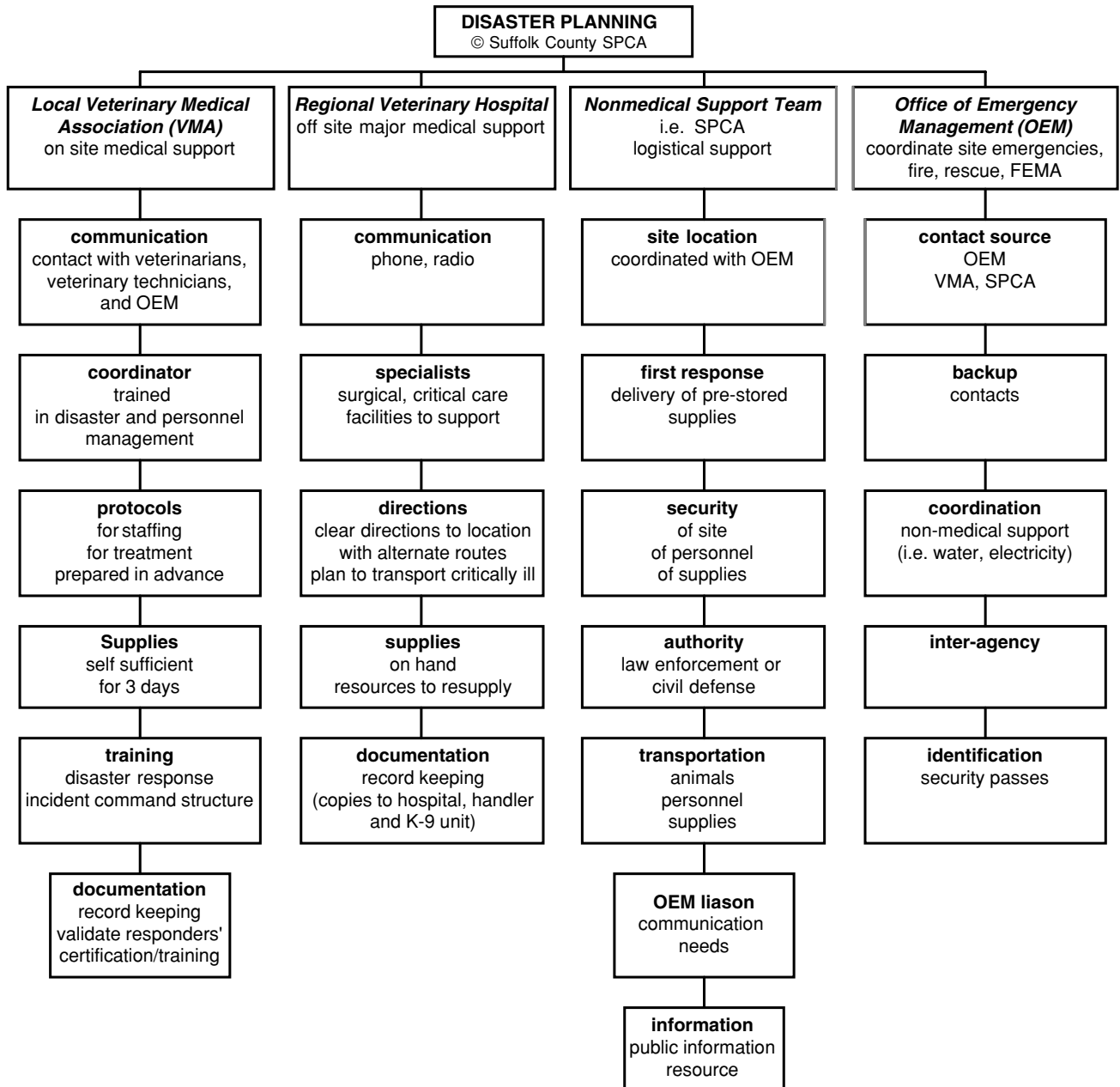
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animals, livestock and wildlife adversely affected. Even in these types of disasters, a special group of dogs appear on the scene and are exposed to the risks involved in their job of search and rescue. The role of the search dogs gained headline news following the terrorist attacks on the Pentagon and World Trade Center. The importance of veterinary preparedness was also realized. The following information is a combination of experiences gained by members of the veterinary community who were actively involved in the medical care of the dogs at the World Trade Center (WTC). The number of veterinarians who volunteered their time, skills, and resources was immense. This reflects the observations and lessons learned from a group of those veterinarians and support agencies involved in the initial response. This article clearly is not the last word, but a starting point to improve our disaster preparedness and care of search dogs in disaster settings.

## Disaster preparedness

Disasters are not planned events; however, a disaster plan is essential for functioning in a disaster situation.<sup>1</sup>



**Figure 1.** Structure of a well-organized disaster plan.  
Abbreviations: SPCA = Society for Prevention of Cruelty to Animals; FEMA = Federal Emergency Management Agency

The Long Island Veterinary Medical Association (LIVMA) had a disaster plan in place, which was essential for a smooth functioning veterinary response. The strength of the LIVMA plan lies in two key factors: active leaders who have been involved in disaster planning, and a long list of members who have agreed to participate in a disaster response. The members of the LIVMA disaster preparedness committee have worked together for several years, and that familiarity allows for a smooth and efficient response. These members have

experience interacting with various governmental and private organizations that were likely to play key roles in the event of a disaster. Experience and planning are the most important factors in preparing for an effective emergency response (Fig. 1). Structuring the response so that volunteers are coordinated, recognized, and working within the local emergency response system facilitates an effective response and helps eliminate the chaos that can result from enthusiastic but unprepared volunteers.



**Figure 2.** Suffolk County SPCA Mobile Animal Surgical Hospital (MASH) unit. (Photo by Marc Franz).

The local disaster planning prior to the WTC attack was generally geared toward a natural disaster. A hurricane would be the most common large-scale disaster to impact the Long Island geographic area. The LIVMA had seen the impact that Hurricane Andrew had on south Florida, and recognized that hurricanes are always a possibility in the coastal Northeast. With this in mind, the plan addresses the possibility and/or eventuality of displaced families and pets, loose animals, and loss of certain infrastructure. The WTC situation presented many different issues. Most of the disaster work was field care of search and rescue dogs that were working the site. Because the disaster responders were largely from outlying counties, the member veterinary hospitals and their patients were minimally impacted and thus the members did not have any significant worries about their own families' food and shelter. They were extremely responsive to the call for help and filled a work schedule that afforded several veterinarians and technicians at the site 24 h a day, seven days a week. By September 14, thanks to the initiative of Dr Barbara Kalvig and LIVMA coordinators, the schedule was filled until early November. It should be noted that local licensed veterinary technicians were also very active in the disaster response.

### When the disaster strikes

In the event of a disaster, veterinarians who are personally affected by the disaster are unlikely to be involved in providing care. They will be focused on securing their resources, and gaining safety for their personnel and animals in their care at the time of the disaster. The best thing we can do for the veterinary profession and animal welfare in general is to free up those individuals to address their own personal problems. This emphasizes the importance of a good disaster plan for each practice, which integrates into the regional plan. If a veterinarian is able to provide disaster care, the first step is to make contact with the local coordinating agency (Fig. 1). In the situation in lower Manhattan, The New York Police Department K-9 unit initiated contact with the Suffolk County SPCA (Society for Prevention of Cruelty to Animals) and invited them to bring their MASH unit to New York. In turn, the Suffolk County SPCA requested assistance from Dr Barbara Kalvig, the AMC (Animal Medical Center), and the LIVMA.

Your disaster preparedness kit should include all of the key phone and contact numbers for local, regional, and state Emergency Operations. If there is no agency in



**Figure 3.** VMAT First Aid Station at the Javits Convention Center. (Photo by Marc Franz).

place to provide care for animals, contact the local or state Emergency Operations Center. It is imperative for your safety that in a disaster setting you work within the framework of the overall Emergency Response. It is important that one's actions coordinate with that of other involved organizations, particularly those of the law enforcement agency in charge of the disaster. More Operations Emergency Management (OEM) people are becoming receptive to the importance of planning for some type of animal involvement in a disaster and the potential role of veterinarians. OEM centers can provide help with logistics, information on safety and crime scene concerns, as well as serving as a conduit for animal related issues. A potentially more difficult task can be the seamless integration of animal related organizations. Coordination may be easy if the disaster is small/local and only a few groups are involved; however, it may be much more difficult if the problem is large and many groups are participating. Communication is the key. Pre-established memorandums of understanding between emergency response organizations and veterinary responders facilitate integration of veterinarians into the emergency response. The Veterinary Medical Assistance

Teams (VMAT) have such agreements with the Federal government.

One of the first tasks in establishing a medical unit at a disaster site is to identify a safe location. The supervising Emergency Response Team will usually assign this location. Safety of the workers is paramount. Prior to starting any medical treatment, it is critical to identify available local resources, the most important of which is to identify one or more fully equipped and staffed veterinary hospitals that are functioning normally and can provide continued care of seriously injured or ill animals. The second task is to make sure that transportation is available and directions (including alternate routes) to the location are clear. Other critical tasks required for a functional medical unit, include adequate record keeping. Part of the preparedness plan should include a system for medical records for animals treated as well as supplies used and supplies needed. The veterinary providers should maintain original records, contribute to a central log and provide copies of all records and treatments to the owner/handler of the animals treated. Veterinarians at a disaster site may be called upon to treat an array of animals injured in the disaster. The

**Figure 4.** Checking pads for injuries. (Photo provided by Cynthia Otto).



following commentary will focus on treatment of the search dogs since this represented the major role of veterinary care at the WTC.

In addition to a veterinary treatment location at or near the disaster site (the Suffolk SPCA MASH unit, Fig. 2), the experience of the WTC has led to the recognition that several locations of veterinary care facilitate a coordinated system for the delivery of services. A forward triage site located at Ground Zero was able to provide minor medical care, identify dogs that needed additional attention at the MASH unit or required evacuation to a referral center. Additionally, the Federal Emergency Management Agency housed all of the Urban Search and Rescue Teams at the Jacob Javitz Convention Center. A veterinary treatment center on site proved invaluable for medical care of urgent (but non-emergency) conditions of the search dogs (Fig. 3). Although veterinary medicine prides itself on autonomy and decisions made by individual clinicians, in a disaster setting, institution of predetermined treatment protocols can have several advantages. Included in these advantages are: (1) consistent care of the dogs which facilitates trust between the handlers and the multiple different care providers; (2) easier record keeping; (3) a more efficient inventory; and (4) an established standard of care. In addition to protocols for treatment of specific conditions, protocols will facilitate identification and movement of animals that should be transferred to local veterinary hospitals or referral centers.

### Treating the working search dog

#### Preventive care

While medical therapy is an essential part of the veterinary role, prevention of injuries and illness is even more

important, especially in a disaster setting. At the WTC, preventive care focused on bathing the dogs to eliminate dust and dirt as well as decontamination of potentially hazardous materials. Similar to the disaster in Oklahoma City,<sup>2</sup> preventive care involved the removal of debris and irritants that could lead to injury. The dust and smoke were potent irritants and the air was hot and dry. On site, the dogs' eyes were frequently flushed with a saline solution. Copious use of the eye rinse helped flush the nasal passages; in addition, wiping the nose and mouth was useful to remove superficial contaminants. The concrete dust was very abrasive and when wet would pack between the dogs' toes leading to dermatitis. The dogs' feet needed to be inspected for cuts and lacerations regularly (Fig. 4). It was also necessary to clean the dust and mud from their paws regularly. Prior to returning to work, it was important to dry the dogs' feet. Initially, most of the dogs did not wear protective booties. The nature of the rubble pile was such that they required traction. In addition, urban search and rescue dogs train on this type of material and learn to walk carefully amidst the debris. Overall, considering the potential hazards, the incidence of foot injuries was remarkably low. By the end of the first week, some of the dogs wore booties. The dogs needed to be bathed at regular intervals – usually at the end of a work shift, or sooner if contaminated with a known toxin. A complete rinse with water was sufficient to eliminate dust and many topical contaminants. Bathing with a detergent (e.g. Dawn<sup>a</sup> or GOJO<sup>b</sup>) was needed for oil-based contaminants. In a disaster with mass casualties such as the WTC, contamination from human body parts/fluids is a concern. It is important to consider these potential risks in handling the dogs due to infectious agents (e.g. HIV, hepatitis, etc.) that are not part of routine veterinary practice.

A major problem experienced by several of the dogs was dehydration. Several factors are likely to have contributed to the dehydration. Some of the factors include the hot dusty environment; the heat emitted by the internal fires, the long work hours without adequate breaks for the handlers or the dogs, and decreased water consumption during work. Many dogs required subcutaneous fluids. Ideally, the veterinarian can counsel the dog handler on strategies to prevent dehydration. Most important is adequate fluid consumption. Because dogs are less likely to drink in the hectic setting of the search location, it is strongly recommended that the dogs be taken away from the site at regular intervals for rest and rehydration. The optimal interval is not known, but it appeared that for some of the dogs that rested every 30–45 min, dehydration was less of a problem. Because it became obvious that the dogs were not getting adequate water breaks, many of the handlers brought their dogs to the field hospital for prophylactic fluids. Subcutaneous fluids prior to the dogs starting their shifts seemed to work well. This is similar in concept to a runner intentionally pre-hydrating before a long run/race. In a disaster setting, prior to administration of subcutaneous fluids, it is important to clean the skin and hair area. Administration of antibiotics is probably not necessary in these cases. It is also mandatory to discuss all treatments with the owner/handler and obtain permission for the treatment instituted and provide complete records.

Rest is also critical to allow the dog to cool down. Dehydration and overwork may have contributed to other problems observed in the search dogs such as bloody diarrhea and hematuria. Similar signs have been reported in sled dogs when they are overworked and become dehydrated (*Pers. Comm. Arleigh Reynolds*).

## Medical treatment

### In the field

The emergency conditions that require actual field treatment are limited to the most acute and life-threatening types of emergencies. These include airway obstruction, pneumothorax, shock, and arterial hemorrhage.

Airway obstruction can result from aspiration of debris or trauma to the airway. Treatment of a complete airway obstruction requires emergent intubation or tracheostomy. The first approach is to pass an endotracheal tube. This is facilitated by use of a laryngoscope to visualize the airway and observe any debris that can be removed. Although the veterinarian should be able to quickly intubate an animal without the use of a laryngoscope, in critical situations one should have the equipment available to increase the likelihood of success; therefore, a laryngoscope should be part of a field

medical pack. In some cases, a smaller than expected endotracheal tube may be necessary to establish an airway. If the dog requires sedation for intubation, consider transporting the dog out of the disaster zone to a cleaner and more protected area or to the first aid station, if possible. In cases with partial airway obstruction, oxygen therapy and rapid transport to a veterinary hospital is indicated. Field tracheostomies are heroic measures and should only be attempted in the most critical situations.

Search dogs may develop a pneumothorax from either blunt or penetrating trauma. Unless it is a tension pneumothorax or the dog is in extreme distress, oxygen therapy should be provided and the dog transported out of the field to a first aid station. In cases of a tension pneumothorax, the chest should be clipped dorsally between the 7th and 9th rib space, the skin cleaned with an antiseptic solution, and thoracocentesis performed. In a tension pneumothorax, because the pressure in the pleural space is greater than atmospheric, placement of an over the needle catheter (e.g. 16–18 gauge over the needle catheter) into the pleural space will allow rapid evacuation of air. As soon as the pressure within the space reaches atmospheric, a 3-way stopcock, extension set and large (60 cc) syringe will be necessary to further evacuate air. The dog should be transported with oxygen as soon as possible. Use of a catheter allows repeated withdrawal of air during transport while eliminating the risk of lung laceration from repeated thoracocentesis. Small bore catheters may collapse due to pressure of the intercostal muscles and bending of the catheter.

Dehydration can become so severe that it leads to hypovolemia; treatment of these cases requires intravenous fluid administration. Arterial lacerations (see below), splenic rupture, and other trauma can also lead to hypovolemic shock. Placement of intravenous catheters in a field setting can be a challenge. If a power source is not available, battery operated clippers are necessary to properly prepare the site. A thorough cleaning with an antiseptic solution should be performed prior to catheter placement. Taping a catheter in place can also be challenging in the field. Once the dog is transported to a clean location, the site should be inspected, cleaned, and the catheter re-taped. Isotonic electrolyte solutions should be used for initial fluid resuscitation. If the dog is in shock, fluids should be started at  $90 \text{ mL kg}^{-1}$ , however, frequent evaluation of the dog is key to appropriate fluid therapy. It is important to remember that not all dogs require a full  $90 \text{ mL kg}^{-1}$  for treatment of shock, and thus, fluids should be titrated for each patient. Prior to fluid therapy, the heart and lungs should be auscultated; this may be difficult to perform in a noisy field setting, however, the clinician should try

their best and promptly reassess when the dog is transported to a safe and quieter location.

The first rule in treatment of overt hemorrhage is to stop the bleeding. Direct pressure is the most effective means to control hemorrhage during transport to either the first aid station or veterinary hospital. Clean protective bandage material and an elastic wrap are helpful in emergency control of hemorrhage. When it seems to be ineffective, more padding and more pressure should be applied, with the original bandage left in place. If there is evidence of abdominal hemorrhage, placement of an abdominal wrap should be considered. Abdominal binding, when performed inappropriately, can result in complications; therefore, the veterinarian should be familiar with appropriate techniques.

If there is a possibility of or evidence for spinal trauma, the dog should be taped or secured to a backboard prior to transport.

#### **At the First Aid Station or 'MASH' unit**

A first aid station should be located in relatively close proximity to the disaster site. It should have the ability to treat common emergencies and provide preventive care. The first aid station should recognize cases that require extensive medical care and arrange for transportation as quickly as possible. Part of the disaster planning is to anticipate the types of emergencies that will need to be treated at the MASH unit and prepare appropriate inventory and treatment protocols. The common types of emergencies that can be treated at the MASH unit include minor wounds and lacerations. These can be cleaned, bandaged, and minor wounds sutured. Ocular injuries can be evaluated; the types of ocular injuries expected would be irritation from smoke and dust, foreign bodies, corneal trauma, and ulcers. Dogs can also be evaluated for acute lameness. If lameness requires more extensive evaluation or involves fractures or torn ligaments or tendons, stabilizing bandages can be placed and the dog can be transported for definitive care. Most cases of dehydration can be treated at the MASH unit. At the WTC, many dogs responded well to subcutaneous fluids. If the dehydration is severe enough to cause intravascular volume depletion or shock, aggressive intravenous fluids are necessary. If the MASH unit is too busy to closely monitor dogs on intravenous fluids, they should be stabilized initially and transported to local veterinary hospitals for continued care. At the WTC, the MASH unit was a convenient and effective location for bathing the dogs after each shift or in case of known toxin exposure. Ingested toxins also pose a potential problem in a disaster setting. Induction of emesis with apomorphine<sup>c</sup> or hydrogen peroxide may be necessary. Administration of activated charcoal is beneficial in numerous intoxications and should be readily available.

#### **Intermediate care**

At the WTC, a medical station for urgent and preventive care was also set up at the Base of Operations of the Urban Search and Rescue teams. Dog handlers who did not have a central base of operations used the MASH unit for urgent care. Issues that can be anticipated include diarrhea, urinary tract infections, skin and ear problems and minor lameness. Several dogs at the WTC suffered from bloody diarrhea and hemorrhagic cystitis. There was no evidence of zoonoses, or any particular etiologic agent and the dogs responded to supportive care. The causes of these problems were not clear, but the stress of the work environment may have contributed. At least one dog that had persistent diarrhea following the search mission tested positive for *Campylobacter* spp. and responded to treatment.

#### **Scoop and run**

In preparing a disaster plan it is tempting to plan on providing definitive care for all emergencies. In some disasters, local veterinary support or 24-h care facilities may not be available. However, the most effective approach to providing disaster care is to make use of local resources. Some animals should be transported directly from the field to veterinary hospitals. Animals that have respiratory distress from conditions such as aspiration, smoke inhalation or caustic pneumonitis should be given oxygen therapy and transported to a fully equipped veterinary hospital as soon as possible.

There are several conditions that require initial stabilization but definitive care must be performed at a local or referral veterinary hospital. Any dog with a condition that leads to circulatory shock should be stabilized. In cases of gastric dilatation and volvulus (GDV), treatment of shock should be started prior to any attempt to decompress the stomach. The prognosis is related to the length of time between onset of GDV and surgical treatment,<sup>3</sup> so if initial attempts at decompression fail, transportation to a surgical facility should not be delayed for repeated attempts to pass an orogastric tube. Animals suffering from heat stroke should also be transported for continued treatment and intensive monitoring following initial treatment of shock and cooling. Animals with evidence of head trauma or trauma requiring surgery should also be transported after initial stabilization. Dogs requiring definitive care such as fracture repair should be transported to a local hospital; however, the timing is less urgent.

#### **Special considerations – environmental toxicants**

Due to the nature of the disaster, several types of toxicants were present in the environment at Ground Zero.

Asbestos was identified as a human health concern from the beginning of the search and rescue effort. However, due to limited veterinary experience and information regarding asbestos exposures in dogs, and the fact that it is considered a chronic exposure health risk in humans, the true risk asbestos may have posed to the dogs is unknown. There was an effort for dogs to be rotated continually on and off the 'pile' and some were fitted with goggles. They were not fitted with masks or any form of respiratory protection since they needed to use their olfactory senses and efficient panting was necessary for temperature regulation. Other potential toxicants of concern were concrete dust, dioxins, and PCBs (polychlorinated biphenyls) resulting from burning materials.

The number of automobiles in the area resulted in a risk of exposure to ethylene glycol, the main component of most commercially available antifreezes. If ingested, ethylene glycol has the potential to cause life-threatening renal failure. Prompt diagnosis and treatment is critical to a positive patient prognosis following a significant exposure. Ethylene glycol test kits<sup>d</sup> can be used within 30 min of a suspected exposure. After a suspected exposure to antifreeze, the antifreeze tests can alert veterinary health care providers that prompt and aggressive treatment is warranted. Brake fluids are also a potential concern with damaged automobiles. Brake fluids mainly consist of glycol-containing compounds that are similar to ethylene glycol, and include ethylene glycol butyl ether and diethylene glycol, that are potentially more toxic to dogs than ethylene glycol. Transmission fluid and gasoline contain hydrocarbons, and windshield wiper fluid contains mostly methanol.

There was also concern about the potential presence of lead in the ash. Exposure to lead could occur mainly by the oral route, as well as through inhalation of potentially dangerous amounts of lead as they work. Signs of lead toxicosis in dogs are often gastrointestinal in origin rather than just purely neurologic. After consultation with veterinary toxicologists at the ASPCA Animal Poison Control Center, it has been suggested that it may be worthwhile to monitor whole blood lead levels in dogs working 'the pile.' On site screening consisted of evaluating blood smears for basophilic stippling and nucleated red blood cells.

Lastly, with the presence of pockets of hydrogen sulfide, there was some concern that dogs could be exposed. Since hydrogen sulfide is heavier than air, it could have potentially been present in some of the deep pits and crevices that the dogs were routinely entering during their searches. While small exposures could merely cause ocular and respiratory irritation, large exposures can rapidly cause collapse, respiratory paralysis, and death. In addition to evacuation to fresh

air, oxygen therapy, and diazepam for convulsions, amyl nitrite and sodium nitrite may also be helpful in case of accidental exposure.

## Summary

The WTC effort was extremely successful given the acute nature of the disaster and the need for such a rapid response. This was the first mass scale veterinary support response for search and rescue dogs at a disaster site. It took tremendous effort to build a coalition with all the organizations involved, set up and run an on-site hospital, and provide excellent veterinary care 24/7 for more than 3 weeks. Now that we are able to begin to look back on the event, it is time to critically appraise how things went, and where we need to develop better strategies for planning, implementation, and medical care at the time of a disaster and through the recovery phase.

We should work with the dog handlers to help develop preventive strategies for dehydration and make recommendations regarding the nutrition and training of these dogs. Although specific nutritional requirements will require investigation, it is clear that due to the potential zoonotic hazards associated with feeding raw meat;<sup>4</sup> this practice should be prohibited in a disaster response. In preparation for future 'endurance' missions, perhaps we can gain insight from the nutritional and exercise physiology research in racing sled dogs.<sup>5-8</sup> Finally, for the heroic dogs that participated in this search, we need to monitor them closely for signs of medical or behavioral sequelae from this disaster response.

As veterinarians we need to be prepared for animal issues resulting not only from terrorist attacks such as the WTC, but also be prepared for bioterrorism. Since veterinarians are trained in infectious disease, zoonoses, and comparative biology, our role may be in recognition of outbreaks of foreign or zoonotic diseases. If we are directly involved in a disaster response, we also need to be aware of the bioterrorism risks so that we do not jeopardize ourselves as responders.

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#### Foot notes

- a Dawn Detergent, Procter and Gamble, Cincinnati, OH.
- b GOJO natural orange, GOJO, Akron, OH.
- c Apomorphine, Professional Compounding Pharmacy, Corvallis, OR.
- d Allelic Biosystems Ethylene Glycol Test Kit, PRN, Pharmacol Inc, Pensacola, FL.

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