MASS DECONTAMINATION PROTOCOL FOR MARION COUNTY RESPONSE AGENCIES

EXECUTIVE LEADERSHIP

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ABSTRACT

The problem was that seventeen Marion County Emergency Response Agencies had no mutually accepted guidelines for managing mass casualty decontamination. The purpose of this applied research project was to develop standard operating guidelines for mass casualty decontamination. The research questions addressed federal and state standards and/or guidelines, emergency response community guidelines, Marion County mass decontamination capabilities, and the development of a standard operating guideline.

This was an action research project to identify how to effectively manage a mass decontamination situation using resources available to the first on-the-scene responders. Research identified that there were no federal or state standards for mass decontamination. Identified were guidelines developed by the U.S. Army Soldier and Biological Chemical Command (SBCCOM). These guidelines proved to be the definitive documents from which other identified operating guidelines derived their information. These guidelines identified decontamination purposes, methods, procedures, and approaches along with other field-expedient methods, prioritizing casualties, environmental concerns and cold weather decontamination as main components. Other guidelines referenced enhanced the SBCCOM documents in areas such as communication, victim privacy, personal property collection, biological and radiological decontamination, use of hot water, and use of dry absorbents. Also identified was information relative to the use of on-scene apparatus to construct decontamination corridors for immediate victim decontamination.
The result was the development of a standard operating guideline consisting of the following components: (a) Purpose, (b) Reasons for Decontamination, (c) Principles of Decontamination, (d) Decontamination Solutions, (e) Decontamination Procedures, (f) Decontamination Approaches, (g) Field-Expedient Methods, (h) Prioritizing Casualties, (i) Cold Weather Decontamination, (j) Environmental Concerns (k) Victim Instructions (l) Responder Protective Clothing (m) General Considerations. The firefighter quick reference cards developed by the U.S. Army Research, Development and Engineering Command where adopted for use as on-scene operational checklists. The final recommendation was for the adoption of said Standard Operating Guidelines.
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INTRODUCTION

September 11, 2001 was a turning point in the thinking of Emergency Response Agencies with regard to chemical and biological terrorism decontamination preparedness. Prior to 9/11, decontamination procedures were primarily targeted at first responders and victims of an industrial or transportation chemical accidents. Now, federal, state, and local response agencies recognize the imperative for standard guidelines applicable to hundreds or even thousands of walking wounded, especially for first arriving agencies. First Response Agencies must be adequately prepared to initiate decontamination procedures for incidents involving Weapons of Mass Destruction.

The Mass Casualty Decontamination Research Team (MCDRT) operating under the U.S. Army Soldier and Biological Chemical Command has concluded that “successful decontamination must be executable with resources available in most response jurisdictions; the approaches must save lives and preserve the health of chemically contaminated victims” (U.S. Army Soldier and Biological Chemical Command [SBCCOM], 2000, p. 2).

Consequently, responders should use whatever resources are available in time of need and should select the fastest method available because decontamination is most effective when performed immediately. The key to successful decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people (U.S. Army Soldier and Biological Chemical Command [SBCCOM], 2002, p. ii). These conclusions directly impact the hazardous materials response to mass victim contamination in Marion County, Indiana.

The problem is, that although Marion County Emergency Response Agencies possess various mass decontamination capabilities, there is no standard operating guideline from which
these agencies mutually operate. The purpose of this research is to develop a Standard Operating Guideline (SOG) for mass decontamination for Marion County Emergency Response Agencies.

This is an action research project and the research questions are:

1. What, if any, are the federal or national standards or guidelines for mass decontamination?
2. What, if any, are the state standards or guidelines for mass decontamination?
3. What, if any, are the guidelines in the emergency response service for mass decontamination?
4. What, if any, are the mass decontamination capabilities of Marion County Emergency Response Agencies?
5. What are the guidelines for mass decontamination to be recommended to Marion County Emergency Response Agencies?

**BACKGROUND AND SIGNIFICANCE**

In 1982, the Marion County Hazardous Materials Advisory Council was established to address the growing concerns of hazardous materials and hazardous materials response in Marion County. Over its 22-year history, this Advisory Council has evolved into a multi-jurisdictional working group known as the Marion County Hazardous Materials Task Force (MCHMTF). Currently the MCHMTF consists of representatives from nine of the thirteen fire departments in Marion County. Also represented are the Indianapolis Police Department, County Health Department, County Emergency Management, State Environmental Management, and Indianapolis Public Works.
“It is the mission of the Marion County Hazardous Materials Task Force to facilitate joint planning and cooperation between the members regarding tactical response to a hazardous materials incident” (Marion County Hazardous Materials Task Force [MCHMTF], 2003, p. 1). The functions of the MCHMTF are varied, including development of the hazardous materials portion of the County Emergency Response Plan and functioning as a conduit from which hazardous materials operating guidelines and procedures are developed and disseminated.

On September 11, 2001 terrorists attacked the United States. The resulting outcome was a heightened sense of awareness to the possibility of additional attacks and that the United States was not invulnerable to the terrorist threat. Through congressional actions, funds where allocated for the training of First Responders and the purchase of equipment for response to Weapons of Mass Destruction incidents. That funding was also intended to include training and equipment for mass casualty decontamination. From the funding possibilities, offered through the Fire Grant Act, various members of the MCHMTF have purchased or are intending to purchase equipment for mass casualty decontamination. However, to date there have been no guidelines developed or adopted by the departments or agencies of Marion County for conducting mass casualty decontamination, that could guide these purchases and subsequent use of the equipment. As a result, the purpose of this research document is to identify Standard Operating Guidelines (SOG).

This research project is related to the networking section taught in the manual for the National Fire Academy’s Executive Leadership course that reads “Ability to create and maintain an effective, widely based system of resources that works to the mutual benefit of oneself and others” (National Fire Academy [NFA], 2000, p. SM 10-7). This research project is related to operational objective four of the United States Fire Administration’s manual Executive Fire
Officer Program Operational Policies and Procedures Applied Research Guidelines which states “To promote within communities a comprehensive, multi-hazard risk-reduction plan led by the fire service organization” (United States Fire Administration [USFA], 2003 p. II-2).

**LITERATURE REVIEW**

**Federal or national standards or guidelines for mass decontamination**

Review of existing materials revealed that there are no federal or national standards specific to mass casualty decontamination. In the absence of said standards, existing guidelines on mass decontamination were reviewed.

In 1997, the Department of Defense (DoD), acting under the Defense Authorization Bill, was charged with enhancing the capabilities of federal, state and local emergency responders in incidents involving nuclear, biological and chemical terrorism. The U.S. Army Soldier and Biological Chemical Command (SBCCOM) was assigned the mission to “identify problems and develop solutions to the tasks faced in responding to each incident” (SBCCOM, 2000, p. 1). SBCCOM used a series of exercises called BALTEX (Baltimore Exercise) to identify the need for methods of decontaminating large numbers of people. “Although hazardous materials (HAZMAT) teams have experience and procedures for decontaminating small numbers of chemical victims, the emergency response community has no formal procedures for decontaminating hundreds of victims” (SBCCOM, 2000, p. 1). In February 1998, the Mass Casualty Decontamination Research Team (MCDRT) was formed to study the decontamination process and recommend operational approaches for decontaminating large numbers of potential victims (SBCCOM, 2000).
MCDRT members identified the five basic decontamination principles as: (a) expect at least a 5:1 ratio of unaffected to affected casualties, (b) decontaminate victims as soon as possible, (c) disrobing is decontamination; head to toe, more removal is better, (d) water flushing generally is the best mass decontamination method, (e) after a known exposure to liquid chemical agent, emergency responders should be decontaminated as soon as possible to avoid serious effects (SBCCOM, 2000, p. 3).

The Guidelines for Mass Casualty Decontamination identified several components that might be included in a Standard Operating Guideline (SOG). These components are: “(a) Purposes of Decontamination, (b) Methods of Decontamination, (c) Decontamination Procedures, (d) Decontamination Approaches, (e) Other Field-Expedient Water Decontamination Methods, (f) Non-Aqueous Methods, (g) Prioritizing Casualties, (h) Environmental concerns” (SBCCOM, 2000, p. i). A summary of each of these components is included in this section.

Purposes of Decontamination: Research revealed that the three most important reasons for decontaminating exposed victims are: (a) remove the agent from the victim’s skin and clothing, thus reducing further contaminate from said agent, (b) protect emergency responders and medical personnel from secondary contamination through transfer, (c) provide victims with psychological comfort, at, or near, the incident site preventing the spread of contamination outside the immediate area (SBCCOM, 2000).

“Since the most important aspect of decontamination is the timely and effective removal of the agent, the precise methods used to remove the agent are not nearly as important as the speed by which the agent is removed” (SBCCOM, 2000, p. 4).

Methods of Mass Decontamination: Firefighters should use resources that are immediately available to start decontamination as soon as possible. The most expedient
approach is to use currently available equipment and water. Water alone, soap and water, and water/bleach solutions where considered (SBCCOM, 2000). “The MCDRT recommends rapid use of water, with or without soap for decontamination. However, the process should never be delayed to use soap or any other additive” (SBCCOM, 2000, p. 6).

Decontamination procedures:

Decontamination by removing clothes and flushing or showering with water is the most practical method for mass casualty decontamination. Disrobing should occur prior to showering for chemical agents, if practical. Wetting down casualties as they start to disrobe speeds up the decontamination process and is recommended for decontaminating biological or radiological casualties. The MCDRT recommends that victims remove clothing at least down to their undergarments prior to showering. It is also recommended that a high volume of water be delivered at a minimum of 60 pounds per square inch (psi) to insure that viscous agents are removed (SBCCOM, 2000, p. 7).

Decontamination Approaches: To provide a large quantity of high volume, low-pressure water spray, one of several decontamination systems should be employed. A Ladder Pipe Decontamination System (LDS) could be used. This system is comprised of two engines set side by side, thus creating a corridor that provides water spray from both sides using hose lines, nozzles and deck guns, while a ladder pipe (aerial device) provides a water spray from above (see Appendix A) (SBCCOM, 2000). An Emergency Decontamination Corridor System (EDCS) could be used. “This system uses fire apparatus, ground ladders, and salvage covers to create a privacy barrier and corridors for decontaminating victims” (see Appendix B) (SBCCOM, 2000, p. 8). Various commercially available decontamination systems may also be used.
Other Field-Expedient Water Decontamination Methods: Emergency responders should not overlook existing facilities as a possible means for providing rapid decontamination. Potential decontamination sources might include; activation of overhead fire sprinklers for use as showers, wade and wash in water sources such as public fountains, and swimming pools (SBCCOM, 2000).

Non-Aqueous Methods: If their use is expedient, the use of non-aqueous chemical absorbents such as dry, gelled, or powered decontaminating materials may be appropriate. Commonly available materials include dirt, flour, Fuller’s Earth, baking powder, sawdust, charcoal, ashes, activated carbon, alumina, silica gels, zeolites, clay materials, and tetracalcium aluminate (SBCCOM, 2000). “Although these absorbents may be an expedient means for decontamination, their efficacy has not been determined” (SBCCOM 2000, p. 13).

Prioritizing Casualties: Triage is essential in a mass decontamination situation, where the number of victims could easily exceed the response agencies capabilities to rescue, decontaminate, and treat said victims regardless of their exposure. Responders, therefore, must prioritize victims for receiving decontamination, evaluation, treatment, and transport, while providing the greatest benefit for the greatest number of victims (SBCCOM, 2000). MCDRT recommends that victims be sorted into Ambulatory and Non-Ambulatory categories. Ambulatory Casualties are “Victims able to understand directions, talk, and walk unassisted and are triaged as minimal, unless severe signs and symptoms are present. These casualties should be moved upwind to an assembly area within the warm zone for further prioritization” (SBCCOM, 2000, p. 15). Factors for determining the highest priority for ambulatory victims are: (a) “casualties closest to the point of release, (b) “casualties reporting exposure to vapor or aerosol, (c) casualties with evidence of liquid deposits on clothing or skin, (d) casualties with serious
medical symptoms (shortness of breath, chest tightness, etc.), (e) casualties with conventional injuries” (SBCCOM, 2000, p. 16).

Non-Ambulatory Casualties are Victims who are unconscious, unresponsive, or unable to move unassisted. These victims may be more seriously injured than ambulatory victims and will remain in place while further prioritization occurs” (SBCCOM, 2000, p. 16). It is recommended that non-ambulatory victims requiring decontamination, be prioritized using a medical triage system such as START (Simple Triage and Rapid Treatment/Transport) (see Appendix C) (SBCCOM, 2000). If sufficient resources exist, two decontamination systems should be utilized: one for ambulatory and one for non-ambulatory victims. If there are insufficient resources for two systems, then a single system should be used. Non-ambulatory victims triaged as immediate are a higher priority than the ambulatory victims triaged as immediate and should be processed first. Remaining casualties should be processed in the same manner, with non-ambulatory victims being decontaminated before ambulatory victims (SBCCOM, 2000).

Environmental Concerns:

The Environmental Protection Agency’s (EPA) interpretation of the Comprehensive Environmental Response, Compensation, and Liability Act indicates that “no person shall be liable for costs or damages as a result of actions taken or omitted in the course of rendering care, assistance or advice in accordance with the National Contingency Plan or at the direction of an On-Scene Coordinator appointed under such plan.” EPA recognizes that any level of contamination represents a threat to the environment. However, life and health consideration are paramount. Once any imminent threats to human health and lives are addressed, first responders should immediately take all reasonable efforts to
contain the contamination and avoid or mitigate environmental consequences (SBCCOM, 2000, p. 22).

Also, under the SBCCOM, a companion document was developed addressing cold weather decontamination, noting that “as the ambient air temperature decreases, some wet decontamination processes, while potentially life-saving, present risks that must be balanced against the hazards posed by the chemical agents” (SBCCOM, 2002, p. ii). This document contained components, that might be included in an SOG, which are: “(a) Collection and Assessment of Victims, (b) Decontamination Methods, (c) Post Decontamination” (SBCCOM, 2002, p. iii).

Below is a summary of each of these components.

Collection and Assessment of Victims: The most important consideration during the collection and assessment phase of decontamination operations is triage, which must consider the hazards imposed by the chemical agent and the inherent risks of the decontamination process. Based on an assessment of the situation, casualties should be divided into a symptomatic group and an asymptomatic group. Individuals showing symptoms should be treated and decontaminated promptly. Asymptomatic individuals should be examined for physical signs symptoms of exposure (SBCCOM, 2002).

When responders are unable to determine if an actual chemical agent exposure has occurred, and in those situations where an actual exposure appears unlikely, decontamination should be deferred pending observation and/or scene investigation. If symptoms develop, individuals should be treated immediately (if possible, without exposing responders to the chemical agent), followed by prompt field decontamination by the most expeditious means available (SBCCOM, 2002, p. 3).
Decontamination Methods:

If victims are actually contaminated, the timely removal of the agent is of primary importance. The key to successful decontamination is to use the fastest approach that will cause the least harm and do the most good for the majority of the people. In most situations, this will be a combination of disrobing and water flushing (SBCCOM, 2002, p. 4).

Some cold weather experts recommend an ambient air temperature of 65° Fahrenheit (F.) as a breakpoint for outdoor decontamination (SBCCOM, 2002). Therefore, four decontamination methods, based on ambient temperature and availability of resources, are subsequently presented.

1. Baseline Decontamination: Baseline decontamination is decontamination conducted outdoors when ambient temperatures are 65° F. and above. This method does not require as much planning and is quick and easy to execute. The Ladder Pipe Decontamination System could be used with this method (see Appendix D) (SBCCOM, 2002).

2. Outdoor Decontamination into Heated Enclosure: Method two may be used for outside temperatures down to 35° F. The primary difference from method one is that post decontamination be conducted in an enclosed heated environment (see Appendix D) (SBCCOM, 2002).

3. Indoor Decontamination: In method three, when outside temperatures fall below 35° F. the collection and assessment of victims may be done outdoors along with the removal of any contaminated clothing. Victims should then be moved inside for wet decontamination and post decontamination procedures (see Appendix D) (SBCCOM, 2002).
4. Dry Decontamination and Transport: Before victims are transported to an indoor facility for wet decontamination, alternative dry decontamination techniques such as blotting an absorbent can be used. Whenever possible, outer garments should be removed as soon as possible. This method is recommended for extreme weather conditions or when the temperature is below 35° F. and no other decontamination methods are available (see Appendix D) (SBCCOM, 2002).

Post Decontamination: Care must be exercised after mass decontamination to prevent unnecessary exposure to a cold weather environment. Whenever possible, a shelter and/or dry clothing should be provided. Providing shelter will help minimize physiological hazards as well as providing gender-segregation thereby minimizing psychological stress (SBCCOM, 2002).

The U.S. Army Research, Development and Engineering Command developed two Quick Reference Guidelines outlining the essence of both the *Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Incident*, and *Guidelines for Cold Weather Mass Decontamination During a Terrorist Chemical Incident* as developed by SBCCOM. The *Firefighter Quick Reference Card for a suspected Chem/Bio Attack* (nd) is condensed into the following guidelines for mass decontamination:

(a) Instruct all victims to disrobe and to go through gross decontamination, (b) bag and tag all personal items, (c) use high volume/low pressure water to decontaminate, (d) attempt to control water run-off. However, decontamination of live victims takes priority over controlling water run-off, (e) have a separate decontamination for responders, (f) use the Ladder Pipe Decontamination System (LDS) or the Emergency Decontamination Corridor System (EDCS), (g) nozzle pressure should be between 60 and 90 psi, (h) consider cold weather decontamination issues when decontamination is less certain and
time permits, (i) when the ambient temperature is 65° F. and above, disrobing, decontamination and post-decontamination processing can proceed outdoors, (j) when the ambient temperature is greater than 35° F. and less than 65° F., disrobing and water decontamination can proceed outdoors, but after showering, victims should be moved into a heated shelter, (k) when the ambient temperature is 35° F. or below, disrobing, water decontamination and post-decontamination processing should take place in heated shelters, (l) asymptomatic victims may need to be decontaminated for psychological impact. (U.S. Army Research, Development and Engineering Command, nd)

The Firefighter Quick Reference Card for Mass Decontamination (nd) is condensed into diagrams of the Ladder Pipe Decontamination System and the Emergency Decontamination Corridor System (see Appendix E) (U.S. Army Research, Development and Engineering Command, nd).

The reference Best Practices and Guidelines for Mass Personnel Decontamination uses the SBCCOM document Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident, as one of its main reference sources. Following is a summary of the relevant information that is in addition to that offered in the Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Incident.

This reference suggests that providing the greatest good for the greatest number of people is the goal of a decontamination operation in relation to mass casualty incidents. “That the type of agent and the number of victims will drive the time criticality and effectiveness of various decontamination methods” (Chemical and Biological Defense Information Analysis Center, 2003, p. 12).
As general considerations, (a) decontaminate only what is necessary, (b) decontaminate as soon as possible, (c) avoid becoming a victim, (d) limit the spread of contamination, (e) separate victim and responder decontamination operations, (f) establish and clearly mark an entry point, (g) use megaphones, nonverbal communication and signs with pictures and/or instructions to lead people through decontamination, (h) consider using a rope to guide victims through the decontamination process, (i) decontaminate any person symptomatic or asymptomatic who goes from a contaminated to an uncontaminated area, (j) anticipate the psychological and behavioral responses of victims, (k) when wetting down or showering victims, expose them to water gradually to decrease cold shock, (l) provide climate and water temperature control, hot water should never be used due to the possible increase in chemical skin penetration, (m) non ambulatory victims should be left in place until rescue crews arrive, (n) consider the deceased as your last concern (Chemical and Biological Defense Information Analysis Center, 2003). Being that clothing removal is the most rapid method of decontamination, encourage victims to remove at least their outer layer of clothing from the top down (Chemical and Biological Defense Information Analysis Center, 2003). If a biological agent contamination is suspected, prevent the spread of contamination by containing the hazard and the victims. If feasible, wet victims’ clothing with a light water mist to prevent reaerosolization prior to disrobing (Chemical and Biological Defense Information Analysis Center, 2003).

“Because of privacy and modesty issues, disrobing can create a bottleneck in decontamination procedures. If victims are showing no medical signs or symptoms or are not suspected of contamination, the decision to disrobe should be evaluated” (Chemical and Biological Defense Information Analysis Center, 2003, p. 26). Personal items should be removed and bagged. However, if victims are not suspected of contamination, the collection of personal
items that will immobilize victims or cause significant delays should be evaluated. When personal item are collected, ensure their security. A personal item tracking system may need to be utilized. (Chemical and Biological Defense Information Analysis Center, 2003).

Victims should be instructed to use a rinse-wash-rinse in the showers, using the following procedures:

(a) Conduct initial head to toe rinse. Wash hands and flush face and eyes with copious amounts of water, (b) thoroughly wash face and body paying close attention to mouth/nose, hair, underarms, and genital area, followed by a final, thorough, rinse, (c) minimize mechanical scrubbing, (d) washing and drying supplies such as sponges or towels should be replaced after every use (Chemical and Biological Defense Information Analysis Center, 2003).

The use of commonly available absorbents such as: dirt, flour, baking powder, sawdust charcoal, silica gels, and talcum powder can be used to remove up to 90% of a chemical agent if used within the first few minutes after exposure (Chemical and Biological Defense Information Analysis Center, 2003).

Emergency Decontamination may also be accomplished using firefighters and hose lines with crossed fog patterns in lieu of fire apparatus (Chemical and Biological Defense Information Analysis Center, 2003). The Best Practices Guideline has developed a process for Self/Emergency Decontamination and Field-Expedient Decontamination which is pictorialized in Appendix F (Chemical and Biological Defense Information Analysis Center, 2003).

In summary, guidelines developed by the U.S. Army Soldier and Biological Chemical Command (SBCCOM) appear to provide the definitive information from which other referenced materials have drawn their information. The lack of knowledge and information concerning
mass decontamination illustrates the youth of the emergency response community in dealing with terrorism and Weapons of Mass Destruction.

**State standards or guidelines for mass decontamination**

As in the case of federal standards, research revealed no state standards for dealing with mass decontamination incidents. However the following single guideline was found.

The *Rapid Access Mass Decontamination Protocol* (2003) utilized in north central Connecticut, “was developed to enable local fire departments to gain control of mass-casualty contamination incidents by initiating immediate definitive measures” (Capitol Region Metropolitan Medical Response System, 2003).

On-site initial decontamination is the preferred method of operation when established by first responders utilizing the following guidelines: (a) establish decontamination zones uphill and upwind from the event site, (b) deployment of multiple hand lines or staging of apparatus curbside to curbside, with nozzles attached directly to outlets to form side to side showers, (c) ladder or truck positioned to form top-down shower, (d) establish a containment area for waste-water (Capitol Region Metropolitan Medical Response System, 2003, p. 11).

The initial decontamination process consists of a generalized hosing/wetting of a controlled crowd as they pass in a line toward either a second stage or a multi-corridor process, e.g. a decontamination trailer, or a makeshift fire department corridor. Disrobement is strongly encouraged, especially in the face of a liquid contaminant. Outer clothing layers obviously carry the most contaminant especially if the contaminant is a dry substance or gas (Capitol Region Metropolitan Medical Response System, 2003, p. 11).
This protocol suggests “the combination of simplicity, lack of specialized equipment and training needed, and the resulting speed of delivery, make the following methods a viable first response” (Capitol Region Metropolitan Medical Response System, 2003, p. 19).

1. Two Engine Set-up: Using two engines, the apparatus are positioned to establish a corridor, thus providing the least possible exposure of firefighters to victims during the decontamination process. Engines should be positioned facing in opposite directions (operator panels to the outside), 20 to 30 feet apart creating a corridor (Capitol Region Metropolitan Medical Response System, 2003).

2. Two Engine and One Ladder Set-up: As described in the two engine set-up with the addition of a ladder company. The ladder company is positioned on the exit side of the corridor or, if space allows, on the outside of one of the engine companies (Capitol Region Metropolitan Medical Response System, 2003).

An effective wash pattern may be achieved through the use of a 2 ½ inch fog nozzle attached directly to the side-mounted discharge on each engine. If preferable, a deck gun may be used, but may require greater distance between the engines to achieve proper coverage. Use wide fog patterns that intersect between apparatus. The pattern should overlap and cover as much of the corridor as possible. Position the ladder pipe over the center of the corridor and adjust the pattern so as to cover as much of the corridor as possible. Pump pressure is to be below 50 psi, so normal fog patterns will be altered (Capitol Region Metropolitan Medical Response System, 2003).

Use of a section of hose, laid out to create an S pattern, in the corridor for victims to follow makes a visible decontamination path. This full and wide S shape should cause victims to have maximum 360-degree exposure to the water spray. This will also slow the passage of
victims to insure that they are in the pattern long enough to be decontaminated (Capitol Region Metropolitan Medical Response System, 2003). To fill gaps in the wash pattern, position a hand line at each end of the corridor set diagonally across from each other, concentrating on persons who did not follow the hose line. To direct victims, position a guide at each end of the corridor (Capitol Region Metropolitan Medical Response System, 2003).

All personnel operating within or forward of the corridor must be in firefighter protective clothing. Pump operators, those staffing hand lines, and those serving as entry or exit guides should be in firefighter protective clothing including, self contained breathing apparatus (SCBA) (Capitol Region Metropolitan Medical Response System, 2003).

The Rapid Access Mass Decontamination Protocol specifies that, “the same concepts identified above can be employed with single apparatus companies using multiple hand lines or monitors” (Capitol Region Metropolitan Medical Response System p. 23).

The protocol continues by identifying some special decontamination considerations, which are:

1. Cold Weather Decontamination: The mean temperature for standard outdoor decontamination is approximately 65°F. Below this temperature, persons may be reluctant to follow the standard process. If the outdoor temperature is 35°F to 64°F, then moving persons directly to a warmer environment after outdoor decontamination is critical. At temperatures below 35°F, attempts should be made at using indoor decontamination such as shower facilities, car washes, or swimming pools. (Capitol Region Metropolitan Medical Response System, 2003).

2. Positive Pressure Fans: “For gaseous substances such as anhydrous ammonia or chlorine, persons can be thoroughly decontaminated using positive pressure
ventilation fans set-up approximately 10 to 15 feet away” (Capitol Region Metropolitan Medical Response System, 2003, p. 23).

3. Automatic Sprinkler Systems: “Use one or more sprinkler head to decontaminate persons moving out of a contaminated building, or into a non-contaminated building” (Capitol Region Metropolitan Medical Response System, 2003, p. 23).

4. Dry Decontamination: If no indoor facilities can be accessed, dry decontamination should be considered. Victims should remove outer clothing and blot with paper towels. Victims can then be transported to a warm area for wet decontamination (Capitol Region Metropolitan Medical Response System, 2003).

5. Waste Water Runoff: “Decontamination shall not be delayed while setting up containment, as the saving of lives is your primary function” (Capitol Region Metropolitan Medical Response System, 2003, p. 24).

Besides the information which resembles that of the SBCCOM documents, the *Rapid Access Mass Decontamination Protocol* as developed by the Capitol Region Metropolitan Medical Response System includes information to improve, explain, and enhance that information.

**Emergency Response Service standards or guidelines for mass decontamination**

Literature review of periodicals, and trade journals yielded little in the way of operating procedures for mass decontamination. However, the few articles that did address the procedures and/or protocols of mass decontamination used information derived directly from the documents developed by the U.S. Army Soldier and Biological Chemical Command as addressed earlier in this literature review. Specifically, these articles referred to the SBCCOM recommendation for the use of fire apparatus to form a decontamination corridor system (Rudner, 2004; Sullivan,
Bugdol (2002) states that we do not have the power to force members of the public to undergo decontamination. Casualties have to participate willingly. Unless the public perceives that the equipment provided and the treatment they will receive is beneficial to their health they may leave the scene, thus escalating the incident. He questions, will the public have confidence in a system and offer their full co-operation when faced with the prospect of undressing outdoors, followed by a cold shower provided by hose reels lashed to short extension ladders mounted in-between two engines when, at best, we can only provide limited privacy? Caution is stressed in the use of cold water in the shower area in order to close the skin pores and reduce any absorption of the contaminant. This must be balance against the danger to the individual from both shock and exposure. The risk that the individual will not decontaminate thoroughly due to their intolerance to the cold temperature is also a significant factor. Budgol (2002) points out that the effects and consequences of water run-off on the environment and a contaminate entering the watercourse could be disastrous. Finally he asks, what would be the impact on the fire coverage within any given area, when following a mass decontamination incident, a number of front-line apparatus are unavailable due to cross contamination? (Budgol, 2002, p. 14-15). Budgol’s (2002), solution to the above listed drawbacks, is the recommendation for use of a commercially available decontamination system.

Harris County, Texas’s *Emergency Decontamination Triage and Treatment Standard Operating Guidelines* (nd) include the following components in their guidelines: “(a) Types of chemical Victims, (b) Prioritizing Casualties for Decontamination, (c) START Categories, (d)
Casualty Processing, (e) Purposes of Decontamination, (f) Methods of Decontamination, (g) Decontamination Guidelines, (h) Emergency Decontamination Corridor System (EDCS), (i) Legal and Environmental Considerations” (p. 2). With the exception of the component names, this document is a replication of SBCCOM document *Guidelines for Mass Casualty Decontamination During a Terrorist Chemical Agent Incident* (2000), put into a Standard Operating Guideline format.

The *Decontamination Annex* (2000) of Hillsborough County Fire Rescue also uses the SBCCOM document for the basis of its Standard Operating Guidelines. The components of “(a) Victim Decontamination, (b) Decontamination Procedures, (c) Prioritizing Casualties, (d) Casualty Processing” (p. i) use verbiage straight from the SBCCOM document. The following components have been added or enhanced.

General Decontamination Concepts: General Concepts identify that prevention of contamination is a key component of decontamination. That decontamination procedures should be “tailored to the specific hazards of the site” (Hillsborough County Fire Rescue, 2000, p. 1). Also identified are the minimum requirements for handling contaminated people and equipment which are: (a) prior to entry, site specific procedures will have been developed, (b) operating procedures will be utilized to minimize contact with hazardous substances, (c) decontamination will be performed in areas that will minimize the exposure of uncontaminated people, (d) anyone leaving a contaminated area will be appropriately decontaminated, (e) decontamination procedures will be monitored by the Safety Officer, (f) any commercial Laundry used, will be informed of the potentially harmful efforts, (g) the Incident Commander is responsible for implementation of appropriate decontamination procedures (Hillsborough County Fire Rescue, 2000, p. 1-2).
Mass Decontamination Approaches: The Ladder Pipe Decontamination System (LDS) and the Emergency Decontamination Corridor System (EDCS) (with some nozzle location modification) as found in the SBCCOM are indicated in the procedure. A Mobile Mass Casualty Decontamination System using a trailer and equipment specific to Hillsborough County Fire Rescue is also explained (Hillsborough County Fire Rescue, 2000).

Casualty Decontamination: The Annex lists the specific actions to be taken by decontamination personnel in relation to ambulatory and non-ambulatory patients. Both gross decontamination (strip and wash rinse) and secondary decontamination (rinse/wash/rinse/redress) are addressed (Hillsborough County Fire Rescue, 2000).

Dayton, Ohio addresses mass decontamination in its Metropolitan Medical Response System Plan under the *Component MMRS Plan for Responding to a Chemical, Radiological, Nuclear, or Explosive Weapons of Mass Destruction Incident* (Dayton Fire Department, nd). This document also utilizes information from the SBCCOM document, but arranged under different headings and in a different format. Information in this document that is in addition to that found in the SBCCOM document is:

1. The creation of Hot, Warm and Cold Zones are discussed relative to standard hazardous materials parameters (Dayton Fire Department, nd).

2. Emergency decontamination is divided into three operations. Physical decontamination is described as the removal of outer clothing followed by blotting and flushing with copious amounts of water. Wet decontamination is described as the using of water or a soap and water solution to flush the skin. Technical decontamination is described as the use of alkaline solutions, which may render some materials inactive (Dayton Fire Department, nd).
3. “If fire department units are met by contaminated victims seeking assistance, a preconnected hose line may be deployed, and the victims instructed to proceed with physical and wet self-decontamination” (Dayton Fire Department, nd, p. 13).

4. “Hazardous materials detection (monitoring) should be conducted in the Warm Zone to detect the presence of contaminants and to confirm the effectiveness of victim decontamination” (Dayton Fire Department, nd, p. 13).

5. “A call will be placed to the Federal Aviation Administration at Dayton International Airport requesting an immediate flight restriction zone” (Dayton Fire Department, nd, p. 13).

As with references available on both the federal and state levels, guidelines developed for specific agencies of the emergency response service have relied on information developed by SBCCOM. As agencies continue to develop guidelines, the body of available knowledge should be substantially increased.

The research question involving Marion County Response Agency capabilities will be addressed with the use of a questionnaire. The research question for guideline recommendations is the final product of this research paper.
PROCEDURES

The purpose of this applied research project was to develop a procedure for managing mass casualty decontamination. To accomplish this, the following steps were utilized.

Process

Step one: A literature review was conducted gathering material available through the Learning Resource Center located at the National Fire Academy. Information from the National Fire Protection Association (NFPA), Occupational Safety and Health Administration (OSHA), United States Military, State agencies, and various fire service organizations and periodicals received through subscriptions were also researched. An Internet search was conducted using the search parameters of decontamination, mass decontamination, mass casualty and mass casualty decontamination.

Step two: Using the accumulated contacts of the four year Executive Fire Officers Program, and other accumulated fire service contacts, an Email was sent requesting SOP’s or SOG’s for mass decontamination. A list of the agencies contacted may be found in Appendix G.

Step three: A questionnaire was developed and forwarded to each member of the Marion County Hazardous Materials Task Force concerning their agencies capabilities (see Appendix H).

Step four: Based on the research, a standard operating guideline was developed (see Appendix I).

Step five: The standard operating guideline will be submitted to the MCHMTF for review, revision, approval, and dissemination.
Limitations

The scope of the materials used in the research of this project was limited in several ways. First, research identified that there were no formal standards available on a federal, national, or state level on mass decontamination. The search for guidelines and/or military documents was also limited. However, it might be noted that military information involving mass casualty decontamination has a direct link to operations involving terrorist events. It is possible that documents of a classified nature addressing this issue exist, but are unavailable to this researcher. Second, the information available through the Learning Resource Center at the National Fire Academy was limited. Many references spoke of the need for mass decontamination, but few elaborated. Third, the ability to gather information at a state level was limited to using the Internet and contacting individuals. There is no single point for the accumulation for state developed materials involving this subject found by this researcher. Fourth, ability to gather standard operating guidelines from other departments was hampered by the contacted departments either having no SOG’s themselves or not responding to inquiries. Fifth, the six-month completion requirement is a limiting factor.

Definition of Terms

BALTEX, Baltimore Exercise.

DoD, Department of Defense. An agency of the United States Government.

EDCS, Emergency Decontamination Corridor System. System for mass casualty decontamination.

EPA, Environmental Protection Agency. An agency of the United States Government.

F, Fahrenheit. A measurement of temperature.
**Guideline.** Suggested principle by which to make a judgment or determine a policy or course of action.

**HAZMAT.** Hazardous Materials.

**LDS.** Ladder Pipe Decontamination System. System for mass casualty decontamination.

**MCDRT.** Mass Casualty Decontamination Research Team. Research group of the Soldier and Biological Chemical Command, U. S. Army.

**MCHMTF.** Marion County Hazardous Materials Task Force. Working Group consisting of multi-jurisdictional representation.


**NFPA.** National Fire Protection Association. A standards making organization.

**OSHA.** Occupational Safety and Health Administration. An agency of the United States Government.

**PSI.** Pounds per Square Inch. A measurement of pressure.

**SBCCOM.** Soldier and Biological Chemical Command. Sub-Branch of the United States Army.

**SCBA.** Self-Contained Breathing Apparatus.

**SOG’s.** Standard Operating Guidelines. A set of guidelines used to direct the activities of an organization.

**SOP’s.** Standard Operating Procedures. A set of procedures used to direct the activities of an organization.

**Standard.** Verbiage developed, usually by consensus group, to be used as a rule.

**START.** Simple Triage and Rapid Treatment/Transport. A system for the sorting of victims.
USFA. United States Fire Administration. An agency of the United States Government.

RESULTS

A questionnaire was produced to address the question of Marion County mass decontamination capabilities. That questionnaire may be found in Appendix H.

Answers to Research Questions

Research Question 1. What are the federal or national standards or guidelines for mass decontamination? A search of the literature identified that organizations such as OSHA and NPFA, which develop and propagate standards for the fire service and industry have not addressed the issue of mass decontamination. In lieu of specific standards, a search for any other federal documents was instituted with limited results. This search produced two primary documents, Guidelines for Mass Casualty Decontamination, and Guidelines for Cold Weather Mass Casualty Decontamination, developed by the Mass Casualty Decontamination Research Team (MCDRT) operating under the Soldier and Biological Chemical Command (SBCCOM) from which most of the other resources cited in this research derived their information.

In 1997, acting under the Defense Authorization Bill, the SBCCOM, under DoD, was assigned the task to “identify problems and develop solutions to the tasks faced in responding to incidents involving nuclear, biological and chemical terrorism” (SBCCOM, 2000, p. 1). SBCCOM identified that “although HAZMAT teams have the experience and procedures for decontaminating small numbers of victims, the emergency response community has no formal procedures for decontaminating hundreds of victims”, which may be needed in a terrorist incident (SBCCOM, 2000, p. 1). As a result the MCDRT was formed to study the decontamination process and recommend operational approaches for the effective
decontamination of large numbers of victims (SBCCOM, 2000). The document *Guidelines for Mass Casualty Decontamination* (2000), developed by the MCDRT identified the five basic decontamination principles as:

(a) expect at least a 5:1 ratio of unaffected to affected casualties, (b) decontaminate victims as soon as possible, (c) disrobing is decontamination; head to toe, more removal is better, (d) water flushing generally is the best mass decontamination method, (e) after a known exposure to liquid chemical agent, emergency responders should be decontaminated as soon as possible to avoid serious effects (SBCCOM, 2000, p. 3).

These principles were further broadened into operating guidelines which included the components of: “(a) Purposes of Decontamination, (b) Methods of Decontamination, (c) Decontamination Procedures, (d) Decontamination Approaches, (e) Other Field-Expedient Water Decontamination Methods, (f) Non-Aqueous Methods, (g) Prioritizing Casualties, (h) Environmental Concerns” (SBCCOM, 2000, p. i).

The Purposes of Decontamination component identifies, that how a contaminate is removed is not nearly as important as how quickly it is removed. That the quick removal of the contaminate protects the victim from further exposure, protects responders from secondary exposure and provides victims psychological comfort at the site thereby limiting the spread of contamination (SBCCOM, 2000).

The Methods of Mass Decontamination component recommends that water or soap and water be used for decontamination. That decontamination should not be delayed to obtain soap or other additives. That decontamination should be started immediately using available resources (SBCCOM, 2000).
The Decontamination Procedures component suggests that clothing removal, at least down to undergarments, and flushing is the most practical method for decontamination. Wetting down while disrobing speeds up the processes especially for biological and radiological contamination. A high volume of water at a minimum of 60 psi pressure be used to insure contaminate removal (SBCCOM, 2000).

The Decontamination Approaches component states that a large quantity of high volume, low-pressure water spray should be used. Two specific approaches are discussed within this component. The LDS, using engines and an aerial device to create an open decontamination corridor, and the EDCS, using engines and tarps to create a semi-private decontamination corridor (SBCCOM, 2000). Each system is pictorialized in Appendix A & B.

The Other Field-Expedient Water Decontamination Methods component recommends that the use of existing facilities is a viable option. The use of fire sprinkler systems, public fountains, and swimming pools should not be overlooked (SBCCOM, 2000).

The Non-Aqueous Methods component identifies that the use of dry, gelled, or powered absorbents may be useful in some situations. However, there effectiveness has not been determined (SBCCOM, 2000).

The Prioritizing Casualties component notes that the number of victims could easily exceed a response agencies capability. Therefore, prioritizing victims for decontamination, evaluation, and treatment, would provide the greatest benefit for the greatest number of victims (SBCCOM, 2000). Victims should be categorized into Ambulatory Casualties and Non-Ambulatory Casualties.

Ambulatory Casualties are “victims able to understand directions, talk, walk unassisted and are triaged as minimal. These casualties should be moved upwind to an area within the
warm zone for further prioritization” (SBCCOM, 2000, p. 15). Highest priority for ambulatory victims are those closet to the point of release, those reporting exposure to vapor, aerosol or with evidence of liquid deposits, those with serious medical symptoms and those with conventional injuries (SBCCOM, 2000).

Non-Ambulatory Casualties are “victims who are unconscious, unresponsive or unable to move unassisted” (SBCCOM, 2000, p. 16). They should remain in place and be triaged using a medical triage system such as START (See Appendix C) (SBCCOM, 2000). If resources exist, two decontamination corridors should be used. If only one corridor is used non-ambulatory victims triaged as immediate take priority over ambulatory victims, with remaining victims processed in the same manner (SBCCOM, 2000).

The Environmental Concerns component states that:

The Environmental Protection Agency’s (EPA) interpretation of the Comprehensive Environmental Response, Compensation, and Liability Act indicates that “no person shall be liable for costs or damages as a result of actions taken or omitted in the course of rendering care, assistance or advice in accordance with the National Contingency Plan or at the direction of an On-Scene Coordinator appointed under such plan.” EPA recognizes that any level of contamination represents a threat to the environment. However, life and health considerations are paramount. Once the health and life threat has been addressed all reasonable efforts should be undertaken to contain the contamination and avoid or mitigate environmental consequences (SBCCOM, 2000, p. 22).

MCDRT also developed a companion document addressing concerns related to cold weather decontamination. The MCDRT noted that as air temperatures decrease, wet decontamination may present risks, therefore, the life-saving potential of wet decontamination
must be balanced against the hazards of the contaminate (SBCCOM, 2002). This document contained three relative components: “(a) Collection and Assessment of Victims, (b) Decontamination Methods, (c) Post Decontamination” (SBCCOM, 2002, p. iii).

The Collection and Assessment of Victims component suggests that triage is of most importance. Victims should be divided into a symptomatic group and an asymptomatic group. Those showing symptoms should be treated and decontaminated promptly followed by asymptomatic victims (SBCCOM, 2002). This supports the concept of ambulatory/non-ambulatory triage as suggested in the previous document. Also recommended, is that if actual chemical exposure is undeterminable or appears unlikely, decontamination should be deferred. If symptoms develop, decontamination should occur immediately (SBCCOM, 2002).

The Decontamination Methods component points out that if there is actual victim contamination, then disrobing and flushing is the most likely method that “will cause the least harm and do the most good for the majority of the people” (SBCCOM, 2002, p. 4). With cold weather experts recommending that the breakpoint for outdoor decontamination is an air temperature of 65°F, four methods of decontamination where suggested (see Appendix D). The Baseline Decontamination Method is conducted outdoors in air temperatures above 65°F. The LDS could be used (See Appendix A) (SBCCOM, 2002). The Outdoor Decontamination into a Heated Enclosure Method is used when air temperature is between 35°F and 65°F. In this method victims move into a heated enclosure after outdoor baseline decontamination (SBCCOM, 2002). The Indoor Decontamination Method is used when air temperatures are below 35°F. Victim collection and assessment along with removal of contaminated clothing is done outdoors, then victims are moved inside for wet decontamination (SBCCOM, 2002). The Dry Decontamination and Transport method is used when air temperatures are below 35°F and
victims must be transported to an indoor facility. Also to be used in extreme weather conditions or when no other decontamination methods are available. Dry decontamination is the use of dry absorbents for blotting and the removal of outer garments (SBCCOM, 2002).

The Post Decontamination component suggests that whenever possible, shelter and/or dry clothing should be provided to help minimize physiological hazards. By providing gender-segregation, psychological stress may be minimized (SBCCOM, 2002).

Research also discovered that the U.S. Army Research, Development and Engineer Command took the information in the SBCCOM documents and condensed it into a user-friendly set of quick reference guides. The Firefighter Quick Reference Card for Mass Decontamination diagrams both the Ladder Decontamination System (LDS) and the Emergency Decontamination Corridor System (EDCS) (see Appendix E). The Firefighter Quick Reference Card for a Suspected Chem/Bio Attack takes the procedures outlined in the SBCCOM documents and condenses it into the following guidelines:

(a) Instruct all victims to disrobe and to go through gross decontamination, (b) bag and tag all personal items, (c) use high volume/low pressure water to decontaminate, (d) attempt to control water run-off. However, decontamination of live victims takes priority over controlling water run-off, (e) have a separate decontamination for responders, (f) use Ladder Pipe Decontamination System (LDS) or the Emergency Decontamination Corridor System (EDCS), (g) nozzle pressure should be between 60 and 90 psi, (h) consider cold weather decontamination issues when decontamination is less certain and times permits, (i) when the ambient temperature is 65°F. and above, disrobing, decontamination and post-decontamination processing can proceed outdoors, (j) when the ambient temperature is greater than 35°F. and less than 65°F., disrobing and water
decontamination can proceed outdoors, but after showering, victims should be moved into a heated shelter, (k) when the ambient temperature is 35° F. or below, disrobing, water decontamination and post-decontamination processing should take place in heated shelters, (l) asymptomatic victims may need to be decontaminated for psychological impact” (U.S. Army Research, Development and Engineering Command, nd, p-2).

Finally, the Chemical and Biological Defense Information Analysis Center developed the *Best Practices and Guidelines for Mass Decontamination* booklet as a quick reference field guide for use by Emergency Response Agencies. The main resources for this reference where the two SBCCOM documents reviewed at the beginning of this section. However, the Best Practices reference was also expanded to include additional guidelines. Noted, was that “the type of agent and the number of victims will drive the time criticality and effectiveness of various decontamination methods” (Chemical and Biological Defense Information Analysis Center, 2003, p. 12). General considerations included: (a) decontaminate only what is necessary, (b) decontaminate as soon as possible, (c) avoid becoming a victim, (d) limit the spread of contamination, (e) separate victim and responder decontamination operations, (f) establish and clearly mark an entry point, (g) use megaphones, nonverbal communication and signs with pictures and/or instructions to lead people through decontamination, (h) consider using a rope to guide victims through the decontamination process, (i) decontaminate any person symptomatic or asymptomatic who goes from a contaminated to an uncontaminated area, (j) anticipate the psychological and behavioral responses of victims, (k) when wetting down or showering victims, expose them to water gradually to decrease cold shock, (l) provide climate and water temperature control, hot water should never be used due to the possible increase in chemical skin penetration, (m) non ambulatory victims should be left in place until rescue crews arrive, (n) consider the
deceased as your last concern. (Chemical and Biological Defense Information Analysis Center, 2003). Victims should be encouraged to remove at least their outer layer of clothing. Clothing removal should be from the top of the body down (Chemical and Biological Defense Information Analysis Center, 2003). Also noted was, “if a biological agent contamination is suspected, wet victims’ clothing with a light water mist to prevent reaerosolization prior to disrobing” (Chemical and Biological Defense Information Analysis Center, 2003, p. 22, 26).

Victim specific issues were also addressed. Privacy and modesty issues can create a disrobing stall point. If victims are showing no medical signs or symptoms or are not suspected of contamination, disrobing may not be necessary (Chemical and Biological Defense Information Analysis Center, 2003). The collection of personal items that will immobilize victims or cause significant delays should be evaluated. When personal item are collected, insure their security and returnability through the use of a tracking system (Chemical and Biological Defense Information Analysis Center, 2003). Victims should be instructed to use a rinse-wash-rinse procedure in the showers (Chemical and Biological Defense Information Analysis Center, 2003).

As an alternative method of decontamination absorbent materials such as: dirt, flour, baking powder, sawdust charcoal, silica gels, and talcum powder, if used within the first minutes of exposure, can remove up to 90% of a chemical agent. Best Practices and Guidelines (2003) recognized that if all else fails Emergency Decontamination might be accomplished using firefighters and hose lines with crossed fog patterns (Chemical and Biological Defense Information Analysis Center, 2003).

Research Question 2. What, if any, are the state standards or guidelines for mass decontamination? A search for state sponsored or promulgated standards yielded no results. A guideline utilized by north central Connecticut was the only document found that even broadly
fit into the category of a state recognized guideline. Although not specifically referenced in the Connecticut guideline, when reviewed, it becomes apparent that the information closely mirrors that of the SBCCOM documents (Capitol Region Metropolitan Medical Response System, 2003).

In addition to the mirrored information this protocol suggests “on-site decontamination is the preferred method of operation for first responders” (Capitol Region Metropolitan Medical Response System, p. 11). Also discussed is the use of the LDS and EDCS for decontamination but added that a section of fire hose laid in an S shape can be used to create a decontamination path. This will slow the passage of victims and cause a 360-degree exposure to the water spray (Capitol Region Metropolitan Medical Response System, 2003). An optional corridor method would be the use of a single apparatus company using multiple hand lines or monitors (Capitol Region Metropolitan Medical Response System, 2003).

The importance of protective clothing when operating within or forward of the decontamination corridor is addressed. Pump operators, firefighters on hand lines, and those serving, as entry or exit guides should be in firefighter protective clothing including SCBA (Capitol Region Metropolitan Medical Response System, 2003).

An option for use with gaseous substances suggests that positive pressure ventilation fans set at a distance of 10 to 15 feet from a victim could be used for thorough decontamination (Capitol Region Metropolitan Medical Response System, 2003).

Research Question 3: What, if any, are the guidelines in the emergency response service for mass decontamination? As found in the previous questions, the SBCCOM documents were the definitive sources for the operating guidelines available through the emergency response community. The Harris County Texas (nd), *Emergency Decontamination Triage and Treatment*
SOG (nd), the Hillsborough County, *Decontamination Annex* (2000), and the Dayton Ohio Metropolitan Medical Response System Plan (nd), adopted much or all of the information recommended in the SBCCOM documents and transposed it into their own department’s format for operating procedures. Additionally, the following points were added to further enhance these operating procedures, which are: (a) “decontamination procedures should be tailored to the specific hazards of the site” (Hillsborough City Fire Rescue, 2000, p. 1), (b) “decontamination procedures will be monitored by the Safety Officer” (Hillsborough City Fire Rescue, 2000, p. 1), (c) “if a commercial Laundry is used, it will be informed of the potentially harmful effects” (Decontamination Annex, 2000, p. 2), (d) “the Incident Commander is responsible for implementation of appropriate decontamination procedures” (Hillsborough City Fire Rescue, 2000, p. 2), (e) a preconnected hose line may be used to provide immediate wet decontamination when first on the scene units encounter victims seeking assistance (Dayton Fire Department, nd), (f) Victim monitoring, in the Warm Zone, should be conducted (Dayton Fire Department, nd).

The use of a decontamination corridor such as the LDS or EDCS, has proven to be the systems of choice in the materials reviewed (SBCCOM, 2000; SBCCOM, 2002; U.S. Army Research, Development and Engineering Command; Chemical and Biological Defense Information Analysis Center, 2003; Capitol Region Metropolitan Medical Response System, 2003; Harris County Operating Guidelines, nd; Hillsborough County Fire Rescue, 2000; Yakima County Fire District 12, 2003; Rudner, 2004; Sullivan, 2004). In contrast, there potentially exists some drawbacks to these systems, which might make their use a less than workable solution. According to Budgol (2002), the use of a commercially available decontamination system would alleviate the following drawbacks: (a) Casualties have to participate willingly. The public must feel that the treatment they will receive is beneficial to their health or they may leave the scene,
thus escalating the incident. (b) Will the public buy into a system made up of nozzles lashed to short extension ladders mounted in-between two engines offering only limited privacy? Will the public offer their full co-operation when faced with the prospect of undressing outdoors, followed by a cold shower? (c) The benefit of a cold-water shower along with the potential shock and exposure must be balance against the danger to the individual and the unwillingness to decontaminate thoroughly due to their intolerance to the cold temperature. (d) The effects and consequences to the environment from water run-off must be considered. (e) The effect on an agencies ability to respond if a portion or their front line apparatus is contaminated and out of service.

Research Question 4: What, if any, are the mass decontamination capabilities of Marion County Emergency Response Agencies? A questionnaire (see Appendix H) was used to address the capability of each department beyond its general fire apparatus from an equipment standpoint, and any written protocols from a procedural standpoint. The results of that questionnaire may be found in Table1.
Table 1

Responses to Mass Decontamination Questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Capability</th>
<th>Specific Set-up</th>
<th>Equip. Location</th>
<th>Trained Persons</th>
<th>Procedures</th>
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<td>Yes</td>
<td>Apparatus &amp; fixed</td>
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<td>Yes</td>
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Research Question 5. What are the guidelines for mass decontamination to be recommended to Marion County Emergency Response Agencies? The result of this research question is the development of a standard operating guideline for use by Marion County Response Agencies. This guideline may be found in Appendix I.

DISCUSSION/IMPLICATIONS

When developing a standard operating guideline, the first step usually involves the research and review of any existing promulgated standards or recommended practices by one of the standards making organizations such as NFPA, or OSHA. Results of research conducted found no existing standards or recommended practices specifically for mass decontamination. This lack of direction opens the door to a wide range of ambiguity and a lack of consensus on
best practices at the federal, state, and local levels. Significant guidance was found, however, in the U.S. Army Soldier and Biological Chemical Command. Through exercises, SBCCOM concluded that while emergency response agencies could handle decontamination involving responders and limited victims, they did not have procedures for decontamination of hundreds of victims (SBCCOM, 2000). This puts agencies in the position of, having to wing it, should said situations arise, which is certainly not optimum. The result of the SBCCOM conclusion was the formation of the Mass Casualty Decontamination Research Team (MCDRT) to recommend operational approaches for mass decontamination (SBCCOM, 2000).

The MCDRT developed what research has proven to be the definitive document for mass Decontamination. This document outlines five basic decontamination principles that set the direction for the entire document. Principle one, “expect at least a 5:1 ratio of unaffected to affected casualties” (SBCCOM, 2000, p.3). This in itself illustrates the need for a mass decontamination procedure by the inability to distinguish between who is and who is not contaminated. Decontamination of any person, symptomatic or asymptomatic would be necessary when moving from a contaminated to an uncontaminated area (Chemical and Biological Defense Information Analysis Center, 2003). Principal two, “decontaminate victims as soon as possible. The timely removal of contaminates is more important than the method used to remove it” (SBCCOM, p.3-4). Principal three, “disrobing is decontamination” (SBCCOM, 2000, p.3). This is contrary to the general thinking that decontamination must include the use of water or a decontamination solution. However, MCDRT presents disrobing as an alternative decontamination option. Principle four, “water flushing generally is the best mass decontamination method” (SBCCOM, 2000, p.3). This is supported by current decontamination practices that identify water and/or soap and water as the best decontaminate. Principle five,
“emergency responders should be decontaminated as soon as possible following a known exposure” (SBCCOM, 2000, p.3). This concept is also supported by current hazardous material practices and common sense.

With these principles in mind the MCDRT developed operating guidelines for mass decontamination. This document included the following components: “(a) Purposes of Decontamination, (b) Methods of Decontamination, (c) Decontamination Procedures, (d) Decontamination Approaches, (e) Other Field-Expedient Water Decontamination Methods, (f) Non-Aqueous Methods, (g) Prioritizing Casualties, (h) Environmental Concerns” (Guidelines for Mass Casualty Decontamination, 2000, p. ii). These components, as outlined earlier in this research, identify minimum guidelines for mass casualty decontamination, developed for the first in responders with limited resources and no mass decontamination specific equipment. Guidelines, that in the opinion of this researcher, backed by 20 years of hazardous materials experience appear reasonable and prudent. Implications of adopting or incorporating these guidelines into an agencies SOG’s would include the need to provide training to understand the concepts, and training in the physical set-up and operations of the LDS and/or ECDS corridors (see Appendix A&B). Also, the adoption of, and training in, the START triage system should be considered (see Appendix C).

Following the development of the Guidelines for Mass Casualty Decontamination, the MCDRT developed guidelines addressing the issue of cold weather mass decontamination. This document builds on the principles of the first SBCCOM document and the use of resources available by first in responders. This is evident in the suggested use of a LDS or ECDS for decontamination in temperatures above 65° F. (SBCCOM, 2002). Further, it is recognized that as ambient air temperatures decrease the risks of wet decontamination in cold weather must be
balanced against the hazards posed by the chemical contaminate (SBCCOM, 2002). This issue is addressed through the recommendation of four methods of decontamination based on ambient air temperature (See Appendix D) (SBCCOM, 2002). Also addressed is the prioritization of victims, which for the most part compliments the first SBCCOM document. However, the Guidelines for Mass Casualty Decontamination (2000), document implies that all victims should be decontaminated, while the cold weather guidelines take a different position. The position, that when weather is a factor, asymptomatic victims should be examined for physical signs and observed for onset of symptoms. If signs and/or symptoms are not observed, if an actual chemical exposure in undeterminable, and/or actual exposure is unlikely, decontamination should be deferred (SBCCOM, 2002). This is a reasonable position when weather and/or lack of resources are a factor.

In an effort to keep it simple, the U.S. Army Research, Development and Engineer Command developed two single sheet, user friendly, quick reference guidelines that condensed the SBCCOM documents into a field useable asset (U.S. Army Research, Development and Engineering Command, nd). The implementation of these quick reference guides would be a quick fix solution until emergency personnel could be provided more formal training.

The other seven references used in this research all use the SBCCOM documents material as their main information source (Chemical and Biological Defense Information Analysis Center, 2003; Capitol Region Metropolitan Medical Response System, 2003; Harris County Operating Guidelines, nd; Hillsborough County Fire Rescue, 2000); Yakima County Fire District 12, 2003; Rudner, 2004; Sullivan, 2004). This might imply that these agencies and/or individuals had the same difficulty in finding subject matter as this researcher. While the SBCCOM documents where the main information sources, a few of the above references did enhance their own
documents with information worth mentioning: (a) The type of agent and number of victims drives time criticality and effectiveness (Chemical and Biological Defense Information Analysis Center, 2003). (b) A rope or hose line laid in an S pattern, which will slow movement and provide 360-degree water spray exposure, can be used to create a decontamination path (Chemical and Biological Defense Information Analysis Center, 2003; Capitol Region Metropolitan Medical Response System, 2003). (c) If a chemical agent contamination is suspected, decontamination should begin immediately. Preconnected hose lines using crossed fog patterns can be used immediately by first in responders (Chemical and Biological Defense Information Analysis Center, 2003; Dayton Fire Department, nd). (d) If a biological agent contamination is suspected, to prevent reaerosolization, wet victims’ clothing with a light water mist, then disrobe (Chemical and Biological Defense Information Analysis Center, 2003). (e) Privacy and modesty issues, can create a disrobing bottleneck, be sure disrobing is necessary (Chemical and Biological Defense Information Analysis Center, 2003). (f) The collection of personal items, such as canes or walkers should be evaluated. Without these items, victims may be immobilized. Any personal item collected should be tagged and bagged (Chemical and Biological Defense Information Analysis Center, 2003; U.S. Army Research, Development and Engineering Command, nd). (g) Hot water should not be used for personnel decontamination. The penetration of the agent into the skin may be increased (Chemical and Biological Defense Information Analysis Center, 2003). (h) At least Firefighter Protective Clothing including SCBA should be worn by pump operators, hand line crews, and entry or exit guides (Capitol Region Metropolitan Medical Response System, 2003). (i) A positive pressure ventilation fan placed 10 to 15 feet from a victim could be used to decontaminate gaseous substances (Capitol Region Metropolitan Medical Response System, 2003). (j) A safety Officer should monitor
decontamination procedures (Hillsborough County Fire Rescue, 2000). (k) When a commercial
laundry is used, it will be informed of the potentially hazardous effects of the suspected
contaminate (Hillsborough County Fire Rescue, 2000). (l) Victim monitoring, with chemical
detection equipment, should be conducted (Dayton Fire Department, nd).

In the experience of this researcher, the above listed enhancements seem viable and
reasonable with one exception. Using a gas powered positive pressure ventilation fan for
gaseous decontamination would put the victim directly in the airflow. This air flow potentially
contains carbon monoxide (from the motor exhaust) far in excess of the 25 parts per million
Threshold Limit Value established by the American Congress of Governmental and Industrial
Hygienists (2002). Data would need to be presented which confirmed that the benefit of this
decontamination method outweighed the potential hazards from carbon monoxide exposure.

It should also be noted that Bugdol (2002), identified some drawbacks to the use of the
LDS or EDCS corridor. Those drawbacks, specifically, a victims’ unwillingness to participate,
effects of run-off, and inability to provide adequate coverage due to cross contamination support
his conclusion that a commercially available decontamination system should be used. However,
the use of a commercially available system would not be practical on an initial response unless
that system would respond to every emergency run. There is still the need for first in responders
to take quick definitive action in the face of mass contamination without having to wait for the
arrival of adjunct support equipment.

The information found in Table 1 (p. 41) outlines the current capabilities of Marion
County response agencies. As noted in the table, only four agencies identified that they have
some mass decontamination capability with only one of those having a specific decontamination
set-up. However, none have any formal written procedures for mass decontamination. Given
that a mass casualty situation would most likely involve multiple agencies, the lack of a base set of guidelines understood by all, could easily lead to confusion, and loss of confidence by the public thereby escalating a victims’ unwillingness to participate.

The adoption of operating procedures, such as those in Appendix I, also carries implications. Once an SOG is adopted, personnel must be trained, necessary equipment purchased, and then the system evaluated through scenario-based trainings on a multi-jurisdictional level. The SOG must also be reviewed periodically and updated as necessary to reflect current fire service thinking and technology. For Marion County the training and update responsibility would logically be the responsibility of the Marion County Hazardous Materials Task Force.

**RECOMMENDATIONS**

The problem is that Marion County Emergency Response Agencies have no standard operating guidelines for mass casualty decontamination. The data collected, supports the recommendation that a procedure be developed to address mass casualty decontamination. This procedure should be in the form of a standard operating guideline developed in the format of the user. At a minimum, this guideline should address areas, which have been found to be mutually contained within the material researched. This would include: (a) Principles of Decontamination, (b) Decontamination Solutions, (c) Decontamination Procedures, (d) Decontamination Approaches, (e) Prioritizing Casualties, (f) Cold Weather Decontamination. Additional areas could be added so as to address issues important to the user.

The standard operating guideline found in Appendix I is this researcher’s interpretation of the research information relative to the needs, training, and resources of Marion County
Agencies. It is the recommendation of this researcher that this guideline be implemented county wide through the following process. (a) Submission to the Marion County Hazardous Materials Task Force for review. (b) Agency Representatives review the guideline with individual department staffs or responsible Chief Officer. (c) Submit suggestions, additions, and/or revision to the Task Force body for discussion and approval. (d) Revise into working document. (e) Evaluate document via scenario based practical test. (f) Revise as appropriate into final document. (g) Gain approval of member agencies. (h) Add to Hazardous Materials Annex of the Marion County Emergency Response Plan. (i) Conduct county wide multi-jurisdictional training.
REFERENCES

American Congress of Governmental and Industrial Hygienists (2002). *2002 Threshold Limit Values for Chemical and Physical Agents and Biological Exposure indices*. Cincinnati, OH: American Congress of Governmental and Industrial Hygienists


Harris County Operating Guidelines. (nd). *Emergency Decontamination Triage and Treatment*. Houston, TX: Houston Fire Department.


Dayton Fire Department, (nd), *Component MMRS Plan For Responding to a Chemical, Radiological, Nuclear, or Explosive Weapons of Mass Destruction Incident*. Dayton, OH: Dayton Fire Department.
APPENDIX A

Ladder Pipe Decontamination System (LDS)
APPENDIX B

Emergency Decontamination Corridor System (EDCS)
### APPENDIX C

Simple Triage and Rapid Treatment/Transport (START)

#### Four S.T.A.R.T. Categories

<table>
<thead>
<tr>
<th>S.T.A.R.T. Category</th>
<th>Decon Priority</th>
<th>Classic Observations</th>
<th>Chemical Agent Observations</th>
</tr>
</thead>
</table>
| IMMEDIATE Red Tag   | 1              | Respiration is present only after repositioning the airway. Applies to victims with respiratory rate > 30. Capillary refill delayed more than 2 seconds. Significantly altered level of consciousness. | • Serious signs/symptoms  
• Known liquid agent contamination |
| DELAYED Yellow Tag  | 2              | Victim displaying injuries that can be controlled/treated for a limited time in the field. | • Moderate to minimal signs/symptoms  
• Known or suspected liquid agent contamination  
• Known aerosol contamination  
• Close to point of release |
| MINOR Green Tag     | 3              | Ambulatory, with or without minor traumatic injuries that do not require immediate or significant treatment. | • Minimal signs/symptoms  
• No known or suspected exposure to liquid, aerosol, or vapor |
| DECEASED/EXPECTANT Black Tag | 4 | No spontaneous effective respiration present after an attempt to reposition the airway. | • Very serious signs/symptoms  
• Grossly contaminated with liquid nerve agent  
• Unresponsive to autoinjections |
APPENDIX D

Cold Weather Decontamination Methods

65 °F and above

METHOD 1
Collection & Assessment
Clothes Off
Decon ≥ 65 °F
Post-Decon
Outdoor

64 °F - 36 °F

METHOD 2
Collection & Assessment
Clothes Off
Decon > 35 °F
Heated Enclosure
Post Decon ≥ 65 °F
Indoor

METHOD 3
Collection & Assessment
Clothes Off
Heated Enclosure
Decon ≥ 65 °F
Heated Enclosure
(Clean Area)

35 °F and below

METHOD 4
Collection & Assessment
Clothes Off
Dry Decon
Transport
Indoor Showers
Indoor Swimming Pool
Hospital Decon

Remove any contaminated outer garments before going indoors.
APPENDIX E

Firefighters Quick Reference Card for Mass Decontamination

LADDER PIPE DECONTAMINATION SYSTEM

LDS

- Advantages
  - Rapid set up time
  - Provides large capacity high volume low pressure shower
  - Rapid hands free mass decontamination
- Disadvantages
  - No privacy
  - Increased chance of hypothermia from exposure to elements
- Composed of:
  - Ladder pipe/Truck
  - 2 engines
  - Hand held hose lines
- Set up:
  - Engines placed approximately 20 feet apart
  - 2 ½ fog nozzles set at wide fog pattern attached to pump discharges
  - Truck with fog nozzle placed on ladder pipe to provide downward fog pattern
- Firefighters can be positioned at either or both ends of shower area to apply additional decontamination wash

The information presented in this reference card was derived from several technical studies and reports that were produced by the U.S. Army Research, Development and Engineering Command, Edgewood Chemical Biological Center (ECBC) Improved Response Program. These reports can be obtained from the ECBC Homeland Defense Web site at http://www.ecbc.army.mil/hsld and should be referenced in order to fully understand the full extent of responding to a chemical or biological WMD incident.
APPENDIX E

Firefighters Quick Reference Card for Mass Decontamination

EMERGENCY DECONTAMINATION CORRIDOR SYSTEM

EDCS
- Advantages
  - Privacy for victims
  - Separate male/female corridors
  - Shower area can be heated using portable heaters
- Disadvantages
  - Slower set up time than LDS
  - Casualty processing slower
  - Requires more manpower to set up
- Comprised of:
  - 2 Engines
  - Salvage covers
- Set up:
  - 2 engines positioned approximately 20 feet apart
  - 3 ladders placed across and secured to top of engines
  - 4th ladder centered atop the other three ladders and secured
  - 2 nozzles secured to 4th ladder hanging down into shower area
  - Salvage covers draped over ladders to create corridors
APPENDIX F

Best Practices Self and Emergency Decontamination Process
APPENDIX F

Best Practices Expedient Decontamination Process
APPENDIX G

Agencies solicited for Mass Decontamination Guidelines

<table>
<thead>
<tr>
<th>Agency</th>
<th>Location</th>
<th>State</th>
</tr>
</thead>
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<tr>
<td>Livonia Fire and Rescue</td>
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<tr>
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<td>Rancho Santa Margarita</td>
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<tr>
<td>Orange County Fire and Rescue</td>
<td>Winter Park</td>
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<td>OR</td>
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<tr>
<td>Janesville Fire Department</td>
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## APPENDIX G

**Agencies solicited for Mass Decontamination Guidelines**

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<tr>
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<td>Greenville Fire and Rescue</td>
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### APPENDIX G

**Agencies solicited for Mass Decontamination Guidelines**

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<thead>
<tr>
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<tr>
<td>Salem Fire Department</td>
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<td>NH</td>
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</table>
APPENDIX H

Mass Decontamination Questionnaire

1. Department or Agency Name:

2. Questionnaire filled out by: (Name and contact number please)

3. Do you have a Mass Decontamination capability? (if yes please continue)

4. Do you have a specific Mass Decontamination set-up?

5. What Mass Decontamination related Equipment do you have?

6. Is this equipment stored at a fixed location or carried on an apparatus?

7. How many personnel do you have that are specifically trained to operate your Mass Decontamination Equipment?

8. Do you have written Mass Decontamination operating procedures?

Thank you for your participation!
APPENDIX I

Mass Decontamination Standard Operating Guidelines
Marion County Hazardous Materials Task Force

1-1 Purpose
To establish a guideline for first-on-the-scene companies and subsequent arriving companies in dealing with mass casualty decontamination.

1-2 Reasons for Decontamination
Effective decontamination is the timely and effective removal of the agent, understanding that the precise methods used to remove the agent is not nearly as important as the speed by which the agent is removed. Effective decontamination of exposed victims will insure:
- Agent removal from the victim’s skin and clothing, thereby reducing further agent exposure and further effects among victims.
- Protection of emergency responders and medical personnel from secondary contamination.
- Victims are provided with psychological comfort at, or near, the incident site, so as to prevent them from spreading contamination over greater areas.

1-3 Principles of Decontamination
The general principles identified to guide emergency responders in utilizing this guideline are:
- Expect at least a 5:1 ratio of unaffected to affected casualties.
- Decontaminate victims as soon as possible.
- Disrobing is decontamination; head to toe, more removal is better.
- Water flushing generally is the best mass decontamination method.
- After a known exposure to a liquid chemical agent, emergency responders should be decontaminated as soon as possible to avoid serious effects.

1-4 Decontamination Solutions/Agents
The following decontamination solutions or agents should be considered unless another specific solution is indicated or recommended.

1-4.1 Water Alone. Flushing uses shear force and dilution to physically remove chemical agent from the skin.

1-4.2 Soap and Water. A marginal improvement in results may be achieved by adding soap. Soap aids in dissolving oily substances. Liquid soaps are quicker to use than solids, and reduce the need for mechanical scrubbing, however when scrubbing is used, the skin should not be abraded. Baby shampoo is one of the most effective decontamination soaps. Decontamination should not be delayed to add soap.

1-4.3 Bleach and Water. Bleach (sodium hypochlorite) and water solutions remove, hydrolyze, and neutralize most chemical agents. However, this approach is not recommended in a mass decontamination situation where speed is the paramount consideration for the following reasons:
APPENDIX I

Mass Decontamination Standard Operating Guidelines
Marion County Hazardous Materials Task Force

Contact time for effective decontamination may exceed expected shower durations. Bleach solution at the 0.5% level may not be better than flushing with water alone. Bleach solution are not recommended for use near eyes, mucous membranes, or for those with abdominal, thoracic, or neural wounds.

1-4.4 **Dry Agent.** If a radiological agent is suspected, water, flour, or oatmeal, may be used to remove the particulate matter. Also, the use of commonly available absorbent such as: dirt, flour, baking powder, sawdust charcoal, silica gels, and talcum powder can be used to remove up to 90% of a chemical agent if used within the first few minutes after exposure.

1-5 **Decontamination Procedures**

Decontamination by removing clothes and flushing with water is the most expedient and the most practical method for mass casualty decontamination.

- Disrobing should occur prior to flushing for chemical agents, at least down to undergarments. However, victims should be requested to remove all clothing including undergarments in a head to toe manner, prior to flushing (showering). Victims unwilling to disrobe, should be flushed (showered) clothed.
- Wetting down casualties prior to or as they start to disrobe speeds up the decontamination process and is recommended for decontaminating biological and radiological casualties. This will prevent reaerosolization of biologicals, but if water pressure is too high, this may force liquid chemical agents through the clothing onto the skin.
- It is recommended that a high volume of water delivered at a minimum of 60 pounds per square inch (psi) water pressure (standard household shower pressures usually average between 60-90 psi) to ensure the showering process physically removes viscous substances. The actual showering time will be an incident-specific decision but may be as long as two to three minutes per individual. When large numbers of potential casualties are involved and queued for decontamination, showering time may be significantly shortened. This may also be dependent upon the volume of water available.
- Hot water should never be used for personnel decontamination. It may increase the skin penetration rates of some contaminates.
- Victim monitoring should be conducted in the Warm Zone using the appropriate detection devices to determine decontamination effectiveness.

1-6 **Decontamination Approaches**

1-6.1 **Emergency Decontamination.** Emergency or immediate decontamination may be accomplished using hose lines with crossed fog patterns in lieu of fire apparatus.
APPENDIX I

Mass Decontamination Standard Operating Guidelines
Marion County Hazardous Materials Task Force

1-6.2 LDS. The Ladder Pipe Decontamination System as shown in the Firefighter Quick Reference Card for Mass Decontamination (Appendix B) can provide a large capacity shower of high volume, low-pressure water spray for a large number of victims using standard fire department resources. An “S” shape decontamination path should be created using rope or hoselines for victims to follow. This will slow victim passage and cause a 360-degree exposure to water spray.

1-6.3 EDCS. The Emergency Decontamination Corridor system as shown in the Firefighter Quick Reference Card for Mass Decontamination (Appendix B) can provide an enclosed private shower area using standard fire department resources.

1-6.4 Field-Expedient Methods. Existing facilities should not be overlooked when identifying means for rapid decontamination methods.
- Overhead fire sprinklers for use as showers
- Public fountains
- Chlorinated swimming pools (An Olympic-sized pool can decontaminate approximately 800,000 persons contaminated with VX gas before the pool will show any effects of the contaminant)

1-7 Prioritizing Casualties

In a mass casualty situation, the number of victims could easily exceed the response agencies ability to rescue, decontaminate and treat, regardless of a victim’s exposure. Responders must prioritize victims for receiving decontamination, evaluation, and treatment while providing the greatest benefit for the greatest number of victims.

1-7.1 Ambulatory Casualties. Victims able to understand directions, talk, and walk unassisted and are triaged as minimal, unless severe signs and symptoms are present. These casualties should be moved upwind to an assembly area within the warm zone for further prioritization. Factors for determining the highest priority for ambulatory victim decontamination are:
- Casualties closest to the point of release.
- Casualties reporting exposure to vapor or aerosol.
- Casualties with evidence of liquid deposits on clothing or skin.
- Casualties with serious medical symptoms (shortness of breath, chest tightness, etc.).
- Casualties with conventional injuries.

1-7.2 Non-Ambulatory Casualties: Victims who are unconscious, unresponsive, or unable to move unassisted. These victims may be more seriously injured than ambulatory victims and will remain in place while further prioritization occurs. The prioritization of non-ambulatory victims for decontamination will be done using the START triage system.
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1-7.3 Priority. If sufficient resources exist, two decontamination systems should be established: one for ambulatory and one for non-ambulatory. If available resources are only sufficient for a single system, non-ambulatory victims triaged as immediate are a higher priority than the ambulatory victims triaged as immediate. Remaining casualties should be processed in the same manner, with non-ambulatory victims being decontaminated before ambulatory victims. Deceased victims are a last concern.

1-8 Cold Weather Decontamination
As the ambient air temperature decreases, some wet decontamination processes, while potentially life saving, present risks that must be balanced against the hazards posed by the chemical agent. In cold weather, when contamination is less certain and time permits, decontaminate victims using the following guidelines:

- When ambient temperature is 65°F and above, disrobing, water decontamination and post-decontamination processing can proceed outdoors.
- When ambient temperature is greater than 35°F and less than 65°F, disrobing, and water decontamination can proceed outdoors, but after showering, victims should be moved into a heated shelter.
- When ambient temperature is 35°F or below, disrobing, water decontamination and post-decontamination processing should take place in heated shelters.
- When unable to determine if an actual chemical agent exposure has occurred, and in those situations where an actual exposure appears unlikely, decontamination should be deferred pending observation and/or scene investigation.

1-9 Environmental Concerns
The Environmental Protection Agency’s (EPA) interpretation of the Comprehensive Environmental Response, Compensation, and Liability Act indicates that “no person shall be liable for costs or damages as a result of actions taken or omitted in the course of rendering care, assistance or advice in accordance with the National Contingency Plan or at the direction of an On-Scene Coordinator appointed under such plan.” EPA recognizes that any level of contamination represents a threat to the environment. However, life and health considerations are paramount. Once the health and life threat has been addressed all reasonable efforts should be undertaken to contain the contamination.
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1-10 Victim Instructions
Victims should be instructed to use a strip/rinse/wash/rinse procedure for decontamination.
- Remove clothing at least down to under garments, all clothing is preferable
- Conduct initial head to toe rinse. Rinse hands, face and eyes with copious amounts of water.
- Thoroughly wash face and body paying close attention to mouth, nose, hair, underarms, and genital area.
- Thoroughly rinse.
- Minimize mechanical scrubbing.
- Towels or sponges should be replaced after every use.

1-11 Responder Protective Clothing
At a minimum, all personnel operating within or forward of a decontamination corridor including pump operators, firefighters on hand lines and those serving, as entry or exit guides should be in full firefighter protective ensemble including SCBA. However, based on the hazards of the product/agent and the potential exposure to the responder, their specific job assignment may dictate a higher level of protection.

1-12 General Considerations
- Decontaminate only what is necessary.
- Establish and clearly mark the decontamination entry point.
- Use megaphones, nonverbal communication and signs with instructions to lead people through decontamination. Consider non-English speaking victims.
- Anticipate psychological and behavioral actions of victims.
- Decrease cold shock by exposing victims to decontamination water gradually, if possible.
- Provide privacy from onlookers and the opposite sex. This issue can create a decontamination bottleneck.
- Collecting personal mobilization items, such as canes and walkers, could cause significant delays. Decontaminate them with the victim.
- When personal items are collected, insure their security and returnability through a tracking system.
- Decontamination procedures should be monitored by the Safety Officer.
- Relative to the hazard, the effect of apparatus cross contamination should be considered.

1-13 Personnel Field Guide
The Quick Response Guidelines for a Suspected Chem/Bio Attack (Appendix A) and the Firefighter Quick Reference Card for Mass Decontamination (Appendix B) are to be used by first arriving personnel as an on-the-scene reference to conduct mass decontamination operations.
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Quick Response Guidelines for a Suspected Chem/Bio Attack

**Indicators of a Chem/Bio Attack**
- Large volume of calls reporting sick or injured persons with no known reason.
- Numerous persons reporting similar illness (signs/symptoms).
- Numerous calls from the same general geographic area or large gathering of people (e.g., a sporting event) reporting unusual illness.
- Symptoms indicative of chemical agent exposure (drooling, tearing, shortness of breath, difficulty breathing, irritation of the eyes, nose, throat, and/or skin, redness or itching of skin).
- Report of an explosion with little or no structural damage.
- Reports of unexplained liquids (droplets, oily substances).
- Reports of unusual odors (mowed grass, garlic, bitter almonds).
- Reports of a release of a spray (fussing sounds, presence of a mist or vapor).
- Suspicious devices/packages (spray devices, damp/wet packages or bugs, explosive devices that cause little explosive damage).
- Unexplained dead wildlife/animals.
- Discarded PPE (masks, gloves, gowns).

**Determine if there are Live Victims?**
- Look through windows/doors to determine if there are any live victims.
- Incident Commander must determine if rescue of victims will be conducted by using firefighter turnout gear and SCBA or to wait for arrival of HazMat teams with level A protection.
- If there are live victims, turnout gear and SCBA provide sufficient protection for 30 minutes to rescue known live victims in a nerve agent vapor hazard.

If there is the possibility of live victims and you are unable to visually see them from the outside, teamed turnout gear and SCBA provide sufficient protection to conduct a 3 minute reconnaissance to search for live victims in an unknown nerve agent environment. **Two minutes if mustard agent is suspected.**

**Scene Assessment and Safety**
- Don PPE (firefighter turn-out gear and SCBA).
- Stage apparatus upward and upgrade at least 300 feet away from scene.
- Observe plume direction.
- Secure the perimeter/deny access.
- Avoid contact with all liquids.
- Establish Hot Warm and Cold zones.
- Move uninvolved civilians to safe zones.
- Be alert for the possibility of secondary devices. If device is found:
  - Don’t touch or disturb,
  - Do not use radios or cell phones within 300 feet,
  - Notify police and request bomb squad, and
  - Evacuate area around device.
- Remember the perpetrator may be among the victims.
- Request HazMat and police response.
- Shit down the HVAC system.
- Do not perform treatment in the hot zone.
- Remember it is a crime scene, do not disturb evidence.
- Establish accountability system for all personnel.

Note: The risks associated with entering a contaminated area in turnout gear with SCBA must be understood prior to making the decision on performing rescue operations.

**Rescue of Ambulatory Victims**
- Use bullhorns and vehicle public address (PA) system to instruct live ambulatory victims to evacuate.
- Instruct ambulatory victims to evacuate alive non-ambulatory victims.
- If victims cannot be evacuated, instruct them to shelter in place in a safe area.
- After victims have been rescued, move them immediately to the decontamination areas for decontamination ASAP.
- Avoid physical contact with victims.

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## RESCUE OF NON-AMPUTABLE VICTIMS
- Don firefighter turnout gear and SCBA, tape all openings. Follow procedures as outlined in Firefighter Quick Response Guidebook.
- In a known or suspected bio incident, standard turnout gear with SCBA will provide enough protection for bio agents.
- Use PPE fans to decrease chemical agent vapor concentration and to increase protection that standard turnout gear will provide.
- Consider the downwind hazard of unprotected people before using PPE.
- Use negative pressure for ventilation of closed interior rooms.
- If all victims are dead or dying, do not make a rescue attempt.
- Use stretchers to move victims.
- If rescuer comes in contact with the liquid, decontaminate immediately.

## Triage
- Follow the Simple Triage and Rapid Treatment (START) system
- Segregate victims and prioritize victims to go through decon based on:
  - Casualties closest to the point of release
  - Casualties reporting exposure to vapor or aerosol
  - Casualties with severe medical symptoms
  - Casualties with conventional injuries

## CHEMICAL AGENT SYMPTOMOLOGY

<table>
<thead>
<tr>
<th>AGENT</th>
<th>PHYSICAL STATE</th>
<th>SYMPTOMS</th>
<th>ODOR</th>
<th>DECONTAMINATION</th>
<th>PERSISTENCE</th>
<th>DOT ERG</th>
</tr>
</thead>
<tbody>
<tr>
<td>NERVE</td>
<td>Liquid</td>
<td>Pinpoint Pupils, SLUDGE - Salivation, Lacrimation (tearing), Urination, Defecation, Gastro-Intestinal distress, Emesis (vomiting), twitching, convulsions</td>
<td>Fruity</td>
<td>Remove contaminated clothing. Flush with soap and large volumes of water.</td>
<td>Minutes, days to Heavy Concentration</td>
<td>Days to weeks</td>
</tr>
<tr>
<td>VX</td>
<td>Like oil</td>
<td></td>
<td>Sulfur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MUSTARD</td>
<td>Liquid</td>
<td>Eye pain, gritty eyes, reddened skin, large fluid-filled blisters</td>
<td>Garlic</td>
<td>Remove contaminated clothing. Flush with soap and large volumes of water.</td>
<td>Days to Years</td>
<td>135</td>
</tr>
<tr>
<td>Lewisite</td>
<td>Liquid</td>
<td>Immediate eye pain and burning lungs, bee sting blisters, grayish skin</td>
<td>Geraniums</td>
<td></td>
<td>Hours to Days</td>
<td>135</td>
</tr>
<tr>
<td>BLOOD</td>
<td>Gas</td>
<td>Bright red lips and skin, headache, guaifenesin, nausea</td>
<td>Bitter Almonds</td>
<td>Remove contaminated clothing. Flush with soap and large volumes of water.</td>
<td>Minutes</td>
<td>117</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyanogen Chloride</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHOKING</td>
<td>Gas</td>
<td>Coughing, choking, pneumonia</td>
<td>New-mown hay</td>
<td>Remove contaminated clothing. Flush with soap and large volumes of water.</td>
<td>Minutes</td>
<td>125</td>
</tr>
<tr>
<td>Phosgene</td>
<td>Gas</td>
<td>Coughing, choking</td>
<td>Bleach</td>
<td></td>
<td></td>
<td>124</td>
</tr>
</tbody>
</table>
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EMERGENCY DECONTAMINATION CORRIDOR SYSTEM

EDCS
- Advantages
  - Privacy for victims
  - Separate male/female corridors
  - Shower area can be heated using portable heaters
- Disadvantages
  - Slower set up time than LDS
  - Casualty processing slower
  - Requires more manpower to set up
- Comprised of:
  - 2 Engines
  - Salvage covers
- Set up:
  - 2 engines positioned approximately 20 feet apart
  - 3 ladders placed across and secured to top of engines
  - 4th ladder centered atop the other three ladders and secured
  - 2 nozzles secured to 4th ladder hanging down into shower area
  - Salvage covers draped over ladders to create corridors
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LADDER PIPE DECONTAMINATION SYSTEM

- LDS
  - Advantages
    - Rapid set up time
    - Provides large capacity high volume low pressure shower
    - Rapid hands free mass decontamination
  - Disadvantages
    - No privacy
    - Increased chance of hypothermia from exposure to elements
  - Comprised of:
    - Ladder pipe/Truck
    - 2 engines
    - Hand held hose lines
  - Set up:
    - Engines placed approximately 20 feet apart
    - 2 ½ fog nozzles set at wide fog pattern attached to pump discharges
    - Truck with fog nozzle placed on ladder pipe to provide downward fog pattern
  - Firefighters can be positioned at either or both ends of shower area to apply additional decontamination wash

The information presented in this reference card was derived from several technical studies and reports that were produced by the U.S. Army Research, Development and Engineering Command, Edgewood Chemical Biological Center (ECBC) Improved Response Program. These reports can be obtained from the ECBC Homeland Defense Web site at http://www.ecbc.army.mil/hld and should be referenced in order to fully understand the full extent of responding to a chemical or biological WMD incident.
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Mass Decontamination Standard Operating Guidelines
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REFERENCES

Dayton Fire Department, (nd), *Component MMRS Plan For Responding to a Chemical, Radiological, Nuclear, or Explosive Weapons of Mass Destruction Incident.* Dayton, OH: Dayton Fire Department.
Harris County Operating Guidelines. (nd). *Emergency Decontamination Triage and Treatment.* Houston, TX: Houston Fire Department.