

# Emergency Responder Considerations for Decontamination of Incidents

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## Overview

Today there are many concerns raised with regard to the decontamination of emergency response personnel, contaminated victims, and victims of a mass casualty incident at hazardous material/weapons of mass destruction (WMD) incidents. Other incidents that raise concern range from shootings to natural disasters such as hurricanes, floods, tornados, etc. These victims may be exposed to contaminants such as chemical, biological, radiological, nuclear (CBRN), or other harmful products. Emergency preparedness personnel and first responders must prepare themselves for the task of effectively decontaminating these persons by developing, training, and practicing methods with which they can safely remove these products from the victims so that they may be triaged, treated, and transported to medical facilities.

The first arriving emergency response units may be faced with an overwhelming number of victims or just one. The emergency responder will be faced with many decisions upon arrival, including the best available method of decontamination for those affected. The decontamination of multiple civilian casualties (or even just one victim) requires the implementation of effective methods with due consideration of citizen safety, modesty, and sensibility. The idea that first arriving fire engines will simply engage their pumps and charge a deck gun or straight-stream victims is wrong and must be dispelled.

The emergency decontamination of civilians is a critical public safety capability. Whether these people are the victims of a natural disaster, a mass shooting, a terrorist act, or an industrial accident, the effective and efficient decontamination of exposed persons has been demonstrated to result in fewer and less severe casualties. Emergency decontamination, however, is only one part of a rational decontamination plan. Effective decontamination, which both protects exposed persons and provides for the survivability of the emergency health care system, cannot rely exclusively on field decontamination of victims at a single place. The concept of “Decontamination in Depth” provides for multiple opportunities for decontaminating patients—implemented in the field, at hospital emergency rooms, at clinics, at trauma centers, and at all other patient collection points. Decontamination in Depth with field casualty decontamination as a critical centerpiece is the only system feasible for dealing effectively with a mass contamination incident.

This document outlines a practical approach to the issues of field decontamination of victims that have been contaminated by CBRN or other harmful materials. By understanding the basics of contamination and decontamination, the emergency responder can make decisions on why, how, when, and where to decontaminate. Remember that an emergency responder may be a firefighter, law enforcement officer, or EMS responder.

## **What is Contamination?**

There are various types of contaminants that victims may be exposed to. Products such as chemical, biological, nuclear, or a combination of these products may be dispersed in an area either by intentional or accidental means. These products may be liquids, gases, solids, or a combination and can be dispersed as gases, atomized liquids, or solids. As fine particles or droplets are inhaled, digested, or deposited on the skin and clothing of the victims, the product then migrates through the victims’ systems to the organs that are affected by the product.

## **What is Secondary Contamination?**

Secondary contamination, or cross contamination, occurs when the materials are moved from place to place, victim to rescuer, or victim-to-victim to provider. As victims are exposed to the residue of the products, they may carry the products from the area of higher contamination to areas of lower contamination. Those areas can include other persons, places, and equipment. The major problem encountered with secondary contamination is the difficulty in containing the victims to the area of contamination, especially when the incident occurs in a geographically large area.

## What is Decontamination?

Decontamination within the public safety community involves the removal or deactivation of contaminants from people, equipment, and/or the environment. The method and type of decontamination to be used will differ based on several variables. These variables will be discussed later.

## Why Do We Decontaminate and Who Needs to be Decontaminated?

The reason for decontamination is very simple: Hazardous materials must be removed from victims before they can physically harm the affected victim. By removing the product(s), harmful effects may be eliminated. Just because a person is exposed to materials (as noted above) does not mean decontamination is always required. It should be noted that there is a difference between exposure and contamination. Using the “Puppy Accident” model below, we can define the difference between exposure and contamination:

If a puppy has an accident on the sidewalk and you walk up to the little pile of fumes and flies, the following scenarios are present:

- If you breathe the fumes you are exposed and will need medical treatment.
- If you step in the little pile you are contaminated and will need to be decontaminated prior to medical treatment.

So, with this in mind, we need to be careful as to whom we decontaminate. We need to look at the incident as it evolves and be specific to victims in our directions. The victims at this point will be scared, confused, and disoriented. Many victims will be complaining of many issues as they exit the contaminated area.

## How Do We Decontaminate?

There are three types of decontamination that we use to decontaminate victims, responders, and responder equipment. Incident size, number of victims, and available equipment and expertise help discern the type of decontamination to be used. The three basic types of decontamination and their respective applications are:

1. **Technical Decon** is the same on-scene decontamination of personnel and equipment that has been used throughout almost 15 years of hazardous materials response. It is set up during pre-entry and develops the egress and access points to the hot zone. The

purpose for the technical decontamination is for the decon of hazardous materials team, responder, and their equipment.

2. **Emergency Decon** is the process of immediately removing contaminants from both victims and emergency response personnel foregoing the usual set up of the planned decontamination corridor. This procedure is used to remove as much of the product from the victim in order to afford emergency treatment to protect the life of the victim(s). It is usually performed by the first engine company on the scene and uses the FLUSH – STRIP – FLUSH protocol that is instructed for the operations level. Emergency best reflects the manner in which we must consider mass decontamination.
3. **Mass Casualty Decon** is, as stated above, used in an emergency. The process of mass decontamination involves the reduction of or elimination of contamination through expeditious procedures on a large number of effected victims. In order to move multiple victims through a decontamination system, consider what needs to be done: studies have shown that 80% of contaminants are removed with the outer layer of a victim's clothing. Once this clothing is removed, a flushing of the victim with a low-pressure/high volume shower of water will remove additional amount of the contaminant.

The intent of this document is to discuss the use of a simple dry decontamination method that will assist the responder in quickly acting to minimize the impact of wet decontamination methods on the victims. By adding a simple first step, it will reduce the bulk amount of contaminant and the amount of water necessary during further decontamination steps.

## **What is Dry Decontamination?**

Dry decontamination methods are generally the start of any decontamination process. Having the contaminated (or suspected contaminated) individuals remove their clothing and other garments eliminates 80% of the potential contamination, prior to other decontamination methods being employed. Then, dry decontamination, which employs the use of several different methods to remove product from victims without the use of liquids, will be used to remove up to 100% of all suspected contaminants. These methods are as follows:

1. **Scraping** consists of using a spatula, wood tongue depressor, or other handheld implement to physically remove viscous liquid or solids from clothing and skin.
2. **Absorbent Materials** are specially fabricated for dual use materials such as FiberTect, RSDL<sup>®</sup>, flour, Fullers Earth<sup>®</sup>, baking soda, and other dry products to absorb the hazardous material. The premise is to place the dry material on the victim, allow it to absorb the chemical, and then blot the material with a wet tissue.
3. **Adsorbent Materials** adhere to or collect product on material surfaces, forming a molecular film.

4. **Vacuuuming** physically removes solid materials from victims using a vacuum system. The usefulness of this in the field is limited due to the time involved in setup and the fact that the victim must be wearing respiratory protection.
5. **Pressurized Air** is the use of low-pressure air streams to remove solid, dry product from an apparatus and/or other equipment. There are many hazards associated with this method, including respiratory damage and skin damage. This method is not recommended for victims or personnel due to the above hazards.

Absorbent materials (number 2 above) should be used in the decontamination process to “soak up” contaminants, as should adsorbent materials (number 3 above). The major difference between the two similar-sounding methods is that an absorbent material increases in volume in its interaction with the material being absorbed, while an adsorbent material does not increase in volume in the chemical-adsorbent interaction.

For example, think of an absorbent sponge that has soaked up a liquid and the fact that no matter to what extent it is wrung out, some amount of the liquid remains trapped in the sponge. In an adsorbent material, however, the liquid can be completely extracted from the sorbent.

With advances in technology, there are now different absorbent and adsorbent materials available both commercially and from the Department of Defense. Many agencies have purchased or have been issued military M291 personal decontamination kits. Commercially available Low-Cost Personal Decontamination Systems (LPDS) include the FiberTect® Wipe and Reactive Skin Decon Lotion (RSDL).

## **What are the Advantages of Dry Decon?**

There are several advantages to incorporating dry decontamination into the overall decontamination process. For example, dry decontamination will reduce the problems and concerns with wet decontamination during cold weather. It will also allow the victim to self-decontaminate by using the materials provided or be decontaminated by the rescuer with minimal cross contamination due to the efficiency of the dry decon materials. Other advantages include:

1. **Time Effectiveness:** Deploying a dry decon system immediately enables the victim to assist in his/her own decontamination. It allows for the quick removal of the materials from the skin, which will in turn reduce the amount of time victims are in contact with the product, therefore reducing the harm the product(s) can cause.
2. **Cold Weather Operations:** When an incident occurs where the outside temperatures are below 65°F, adverse effects upon the victim (including cold shock and hypothermia) and the use of cold water must be considered.

- a. **Cold shock** occurs when individuals with pre-existing medical conditions are immersed in cold water, which causes blood pressure to dramatically increase. The effects of cold shock can be as severe as unconsciousness followed by cardiac arrest.
  - b. **Hypothermia** is a condition that is caused by extended exposure to cold weather or cold water. It is widely believed by the emergency response community that hypothermia will occur in victims who are doused by cold water in a cold environment (The colder the water, the less time it will take for hypothermia to occur.) Victims should be dried off as quickly as possible then moved to a warm location, re-dressed, and triaged for potential medical intervention. Although victims will start to shiver in reaction to the body attempting to produce warmth, shivering is not an indication of hypothermia.
3. **Logistical Issues:** There are many logistical issues involved in setting up wet decontamination lines that are not necessary for dry decon. As a result, dry decon is faster to deploy and clean-up.
- a. Dry decontamination does not need the establishment of a sustainable water supply immediately. Though water may be used at the end of the process, it is not needed right away. Also, the water does not need to be heated.
  - b. Dry decontamination does not require a large collection basin for waste. Once a pad/wipe is used it can be placed in a lined or unlined drum for proper disposal at a later time.
  - c. Dry decontamination does not require large amounts of resources including hoses, nozzles, shelters, and other large and expensive pieces of equipment.
  - d. Dry decontamination does not require a large number of personnel who may not be available during the initial phase of an incident.

## **What is FiberTect?**

FiberTect is a multi-layer, non-woven composite fabric that has the capability of absorbing and adsorbing chemical, biological, and radiological contaminants. FiberTect is adaptable and can be layered to provide multi-functional use. It is constructed using a bottom and top layer of polyester and/or raw cotton with a middle layer of fibrous activated carbon. The middle layer is then needle-punched with the bottom and top fabrics to form a single and continuous fabric that is strong and does not fall apart. Needle punching is a manufacturing technique that combines the multiple layers into a single material without fillers or additional fibers. This

allows material to be structurally sound while creating void spaces for better absorption and adsorption.

## **How is FiberTect Used?**

FiberTect is field deployable and can be used in many situations; however, there is a proper way to deploy and use FiberTect that makes it the most efficient tool for field decontamination. The following outlines the basic methodology of the use of FiberTect:

**Step 1:** Upon arrival on scene, don protective garments and gloves and remove packages from storage containers.

**Step 2:** Remove the FiberTect from the individual pouch.

**Step 3:** Unfold the pad and place in hand.

**Step 4:** Place open pad on contaminated areas and blot. Allow contaminant to absorb into pad.

**Step 5:** Slowly move pad in single direction with slight pressure. DO NOT RUB BACK AND FORTH.

**Step 6:** Turn pad over and continue using on opposite side. It will continue absorbing contaminant.

**Step 7:** Fold or bend FiberTect in any direction to decontaminate cracks, crevices, corners, and other hard to reach areas.

**Step 8:** When finished using the FiberTect pad, dispose of in accordance with local, state, and federal regulations for disposing of hazardous waste.

**NOTE:** The FiberTect pad can be used on victims as well as emergency response personnel when contamination is a concern. It can also be used on sensitive electronics (such as detection and monitoring devices), radios, and EMS equipment. It works well on firearms and other LE equipment that may become contaminated during a search, seizure, or incident involving chemical, radiological, or biological materials.

## How can FiberTect be Incorporated into Different Decontamination Types?

FiberTect can be incorporated into any of the decontamination types that are employed by responders or those charged with decontamination duties. When discussing emergency responder decontamination types, the incorporation of FiberTect is a simple one.

1. **Technical Decontamination** is set up during pre-entry and becomes the egress and access points to the hot zone and is to be used by the hazardous materials team, responders, and their equipment. FiberTect can be deployed in the area prior to personnel entering the decon line in order to absorb the bulk contaminants on equipment and PPE. It can be used on the ground or tarps to capture contaminants and prevent further contamination prior to responders entering the decon pools. FiberTect pads can be placed at tool drops and used to wipe down equipment for initial removal of bulk contaminants. Since it absorbs and adsorbs the contaminants, FiberTect prevents the movement of the product out of the hot/warm zone.
2. **Emergency Decontamination** is the process of immediately removing contaminants from both victims and emergency response personnel, foregoing the usual set up of the planned decontamination corridor. This procedure is used to quickly remove as much of the product from the victim as possible in order to afford emergency treatment to protect his/her life. Due to the flexibility and portable nature of FiberTect, it can be stored in any response vehicle, commercial vehicle, or facility cabinet: Virtually anywhere an incident may occur. FiberTect is easily deployable and can readily be used to remove the bulk materials from personnel before the product causes further harm.
3. **Mass Casualty Decontamination** involves the reduction or elimination of contamination through expeditious procedures on a large number of affected victims. Moving so many victims through a decontamination system is a time and labor-intensive process. For example, setting up water streams and showers can take a significant amount of time. By using FiberTect during the initial response, the need for large-scale decontamination may be greatly reduced. By handing victims a FiberTect package and explaining its use, responders will gain valuable time in triage, treating, and transporting these victims. In addition, by adding the dry decontamination step and using FiberTect, bulk materials on the victim may be removed, which could provide the victim assurance that they are being taken care of immediately instead of being herded to area and waiting for the wet decon to be set up.



## **How Can FiberTect be Used?**

The manufacturing process used to make FiberTect does several things: It makes a very flexible material that can be made for the task at hand. It has tough mechanical strength and abrasion resistance so that it can be used on all types of equipment to simply wipe down prior to any water being applied, yet it can be used on people to remove both solid and liquid contaminants without abrading or injuring the skin. FiberTect can be placed on a mop or broom and used to clean walls and floors including concrete, wood, plastic, and even steel. It can even be used to wipe down sensitive electrical equipment, such as detection and monitoring equipment, radios, EMS equipment, etc. In the event of a plume, large sheets of FiberTect can be deployed to wipe down apparatus or the effected ground. The manufacturing of FiberTect allows for various form factors of the material, from small wipes, to mitts, to large pads.

## **Is FiberTect Interoperable with Other Decontamination Methods?**

FiberTect can be used with any current decontamination platforms in use. One of the primary benefits of FiberTect is its ability to encapsulate the products and prevent off gassing, which can cause additional harm to victims and responders. A significant benefit of using a dry decontamination platform is that it does not introduce any additional chemical products that can react with other substances. For example, a law enforcement officer can use it after the use of mace or pepper spray to clean the victim and affected areas such as the patrol vehicle. It can also be used in a medical transport unit to wipe down after handling an exposure/contaminated patient or in the event of contamination caused by a radioactive material. Plus, its “cloth-like” materials make FiberTect less bulky and allow for easy disposal. Though FiberTect is considered to be a nonreactive material, caution should be taken when using it with oxidizers.

Below are examples of the interoperability of dry decontamination in the field. These examples are just a few of the ways that FiberTect can be deployed for field operations that will reduce the contact time for the victim and exposure for the responder.

1. **Emergency Decontamination:** Upon arrival to a mall where there has been a release of pepper spray, LE officers or EMS bring a box of FiberTect packaged wipes to be distributed to the exposed and contaminated victims. The responder will set up an area in which the victims can self-decontaminate that would include a receptacle for the debris that is produced. FiberTect, along with RSDL, can be incorporated as part of the Emergency Decontamination in the event of a responder suit breach. The FiberTect can do the initial wipe-down of the PPE for immediate contaminant removal, followed by an application of RSDL for neutralization of the contaminants on the skin.

2. **Technical Decontamination:** Upon arrival at a hazardous materials incident, the HMRT will set up a decontamination system, adding a dry decontamination station prior to entry into the shower, which can reduce the amount of contamination drastically by capturing the contaminants in the FiberTect material.

## **Logistical Support for the Use of FiberTect**

1. FiberTect can be configured to meet any task. Each wipe, mitt, sheet, etc. is packaged in its own sealed package. FiberTect form factors include:
  - a. 6" x 12" or 12" x 12" pad that can be draped and/or folded for use (standard).
  - b. A hand mitt that comes in various sizes.
  - c. 24 " x 24" or 4' x 4' pads for standing on during decontamination.
2. FiberTect does not require any special storage systems. No refrigeration or protection from heat is needed. It can be placed in a "go bag," compartment on a fire apparatus, or in the trunk of a car.
3. FiberTect has shelf life of 10 years when kept in its sealed packaging.
4. Once on scene, simply remove the package of FiberTect from storage and ensure that the package is intact (no tears). Remove the wipe and deploy as directed in previous documentation.

## **Disposal**

FiberTect is a green, environmentally safe product; however, once used it may become a hazardous waste that must be disposed of in accordance with local, state, and federal guidelines.

## **Other Decontamination Considerations**

1. **Equipment** – Some of the solutions mentioned above may be used to decontaminate equipment. Issues that can be addressed prior to an incident are:
  - a. Type of PPE (Reusable or Limited Use)
  - b. Monitor Protection (Bagged in Plastic)

- c. Disposable Supplies
  - d. Cleanup/Disposal Contractors
2. **Apparatus** – Once again, the solutions mentioned above can be used as well as steam jets, pressure washing, vacuuming, and (depending on the depth of contamination) sandblasting.
3. **Buildings and Streets** – The decontamination of structures and streets will offer many challenges to the cleanup contractors and will take an effort that may involve long term remediation, as well as monitoring. Local, state, and federal health officials have to be called in and will have to maintain a presence until the contaminant status is determined.
4. **The Environment** – Many issues will have to be (and have been) addressed with regard to the environment. Decontamination of water and soil will require the assistance of many local, state and federal agencies who will have to determine what is clean and when. The determination of safe levels must be done based on the ability to remove or neutralize the contaminants.
5. **Herding** – This issue must be addressed so that multiple ambulatory victims can be decontaminated in an orderly fashion. The first emergency responders (firefighters, EMS crews, or law enforcement officers) on scene must take control of the crowd as quickly as possible. By using firm, clear, concise, and authoritative commands, victims can be moved to an assembly area where they can then be decontaminated.

## **Practical Applications of Decontamination Procedures for Emergency Responders to Mass Casualty Incidents**

The primary focus of this paper is on the emergency responder dealing with contaminated victims. Upon arrival on the scene of an incident where there are multiple casualties and contaminated victims, the responsibility for decontamination will fall upon the first arriving units. These first arriving units may be fire engines, ambulances or police cars, each of which should have the vital tools necessary to handle this type of incident: FiberTect, water, hoses, and personnel. This means that decontamination is not only the responsibility of the Hazardous Materials Response Team. It is everyone's job. The hazardous materials team should assist in the preplanning and training to meet the needs of fire, EMS, and law enforcement agencies in understanding the concepts of decontamination; however, they will be tasked with duties specific to hazardous materials mitigation.

## **Wet Decontamination of Mass Casualties**

When an incident occurs involving mass casualties, the first arriving engine or truck company will be faced with victims that have been exposed or contaminated by the byproducts of the incident, which may be as simple as concrete dust (which has hazards of its own) or as complex as multiple chemicals from a dissemination device. These victims, in order to be triaged, treated, and transported, must be transformed from victims into patients, and this process must be done safely so that it does not endanger any responder personnel. It must also be performed quickly and effectively so that the casualties can be treated in a timely manner. Effectiveness is crucial so that all victims that have been involved can be safely removed from the scene and treated.

The one thing that all decontamination scenarios have in common is that the first arriving unit must begin the decontamination process with what they bring with them to the scene. For example, the engine company can deploy nozzles and water to remove the contaminant, which has been used to decontaminate firefighter protective clothing for years. The use of the booster line or gutter line to wash debris from a firefighter after a fire is commonplace and the same principals may be applied to the care of multiple victims.

## **Summary**

The purpose of this document is to assist local emergency responders in preparing for an incident involving decontamination of mass casualties. The direction that should be taken is outlined for the responder, as is what can be done if this type of incident occurs. The most important issue, which must be continually addressed, is that responders must act quickly to remove the contaminated victims' outermost layer of clothing and thoroughly rinse any contaminated persons. By following standard operating procedures emergency services providers can quickly turn victims in to viable patients. The other issue that has been addressed is the concept of "Decontamination in Depth". Local emergency responders must coordinate efforts with local hospitals, mutual aid departments, and other response agencies that may assist in a mass contamination incident.

The methods described in this document are guidelines derived from several sources. This is one effective decontamination method and not the only way. Responders must consider the situation and the available resources. The decontamination process does not have to wait for the hazardous materials team to come on scene.