



*System Assessment and Validation for Emergency Responders (SAVER)*

# Individual Officer Trauma Kits Application Note

*October 2015*



**Homeland  
Security**

Science and Technology

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

*Prepared by Idaho National Laboratory*

Approved for public release, distribution is unlimited.

---

The *Individual Officer Trauma Kits Application Note* was funded under Interagency Agreement No. HSHQPM-15-X-00132 from the U.S. Department of Homeland Security, Science and Technology Directorate.

The views and opinions of authors expressed herein do not necessarily reflect those of the U.S. Government.

Reference herein to any specific commercial products, processes, or services by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the U.S. Government.

The information and statements contained herein shall not be used for the purposes of advertising, nor to imply the endorsement or recommendation of the U.S. Government.

With respect to documentation contained herein, neither the U.S. Government nor any of its employees make any warranty, express or implied, including but not limited to the warranties of merchantability and fitness for a particular purpose. Further, neither the U.S. Government nor any of its employees assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed; nor do they represent that its use would not infringe privately owned rights.

The cover photo was provided by the Idaho National Laboratory.

---

## FOREWORD

---

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercially available equipment and systems and develops knowledge products that provide relevant equipment information to the emergency responder community. The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, operationally oriented assessments and validations of emergency response equipment
- Providing information, in the form of knowledge products, that enables decision-makers and responders to better select, procure, use, and maintain emergency response equipment.

SAVER Program knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: “What equipment is available?” and “How does it perform?” These knowledge products are shared nationally with the responder community, providing a life—and cost—saving asset to DHS, as well as to Federal, state, and local responders.

The SAVER Program is supported by a network of Technical Agents who perform assessment and validation activities. As a SAVER Program Technical Agent, the Idaho National Laboratory (INL) has been tasked to provide expertise and analysis on individual officer trauma kits. In support of this tasking, INL conducted research on individual officer trauma kits and their use by emergency responders. Individual officer trauma kits fall under AEL reference number 03OE-03-KTFA, titled Kit, First Aid, Trauma Type.

For more information on the SAVER Program or to view additional reports on other technologies, visit [www.firstresponder.gov/SAVER](http://www.firstresponder.gov/SAVER).

## **POINTS OF CONTACT**

---

### **SAVER Program**

**U.S. Department of Homeland Security**

**Science and Technology Directorate**

FRG Stop 0203

245 Murray Lane

Washington, DC 20528-0215

E-mail: [saver@hq.dhs.gov](mailto:saver@hq.dhs.gov)

Website: [www.firstresponder.gov/SAVER](http://www.firstresponder.gov/SAVER)

### **Idaho National Laboratory**

National and Homeland Security Directorate

Homeland Security Division

P.O. Box 1625, MS 3770

Idaho Falls, ID 83415

E-mail: [saver@inl.gov](mailto:saver@inl.gov)

## TABLE OF CONTENTS

---

|                                 |     |
|---------------------------------|-----|
| Foreword.....                   | i   |
| Points of Contact.....          | ii  |
| 1. Introduction.....            | 1   |
| 2. Technology Overview.....     | 2   |
| 2.1 Gloves .....                | 3   |
| 2.2 Tourniquets .....           | 3   |
| 2.3 Pressure Bandages .....     | 4   |
| 2.4 Hemostatic Dressings.....   | 4   |
| 2.5 Additional Components ..... | 5   |
| 2.6 Size and Portability .....  | 6   |
| 2.7 Training.....               | 6   |
| 2.7.1 First Responder .....     | 7   |
| 2.7.2 Public .....              | 7   |
| 2.8 Cost .....                  | 8   |
| 3. Summary.....                 | 8   |
| Appendix A. References.....     | A-1 |
| Appendix B. Acronyms.....       | B-1 |

## LIST OF TABLES

---

|  |   |
|--|---|
| Table 2-1. Active Shooter Trainings..... | 7 |
|--|---|

## LIST OF FIGURES

---

|  |   |
|--|---|
| Figure 1-1. Active Shooter Incident.....   | 1 |
| Figure 2-1. Individual Patrol Officer Kit (IPOK <sup>®</sup> ), North American Rescue LLC..... | 2 |
| Figure 2-2. Tactical Operations (TACOPS <sup>®</sup> ) Kit, TSSi.....                          | 2 |
| Figure 2-3. Gloves .....   | 3 |
| Figure 2-4. Application of a Tourniquet.....   | 3 |
| Figure 2-5. Packaging Comparison Between a CAT and an E-CAT .....                              | 3 |
| Figure 2-6. Windlass Comparison Between a CAT and an E-CAT .....                               | 4 |
| Figure 2-7. Band Comparison Between a CAT and an E-CAT.....                                    | 4 |
| Figure 2-8. Pressure Bandage .....   | 4 |
| Figure 2-9. Kaolin-based Combat Gauze.....   | 5 |
| Figure 2-10. Chitosan-based Combat Gauze .....   | 5 |
| Figure 2-11. Cloth Tape.....   | 5 |
| Figure 2-12. NPA.....  | 5 |
| Figure 2-13. Face Shield .....   | 5 |
| Figure 2-14. Chest Seals .....   | 6 |
| Figure 2-15. Trauma Shears.....  | 6 |

## 1. INTRODUCTION

---

Individual officer trauma kits contain essential supplies for treating life-threatening traumatic injuries, such as gunshot and stab wounds, in a field environment before certified medical assistance can reach the scene. Whether used for emergency self-care or treatment of another person, these kits—sometimes referred to as individual first aid kits and individual patrol officer kits—can save lives by providing a means to immediately treat life-threatening injuries, primarily by stopping excessive external bleeding. This application note presents information on individual officer trauma kits and their application in response to active shooter incidents (Figure 1-1).



**Figure 1-1. Active Shooter Incident**

*Image courtesy of the Federal Bureau of Investigation (FBI)*

The FBI reports that while the overall rate of gun-related homicides is down, the trend of active shooter incidents has increased since 2000. The FBI defines an active shooter as “an individual actively engaged in killing or attempting to kill people in a populated area.” Between 2000 and 2013, 160 active shooter incidents occurred, with 486 individuals killed and 557 wounded.

Because of this trend, improving the response to these chaotic and complicated environments is critical. The Hartford Consensus III—a guideline developed by the representatives from the American College of Surgeons (ACS), FBI, Department of Homeland Security (DHS), and first responder agencies—notes that early hemorrhage control improves the rate of survival and recommends all first responders carry a “bleeding control bag.” The materials recommended for inclusion include tools aimed at prolonging life between the time the penetrating trauma occurs and intervention at a fully-certified medical facility and include pressure bandages, hemostatic dressings, tourniquets, and gloves. In addition, the consensus recommends the response to an active shooter incident include the following five actions, contained in the acronym THREAT:

- **Threat** suppression
- **Hemorrhage** control
- **Rapid Extrication** to safety
- **Assessment** by medical providers
- **Transport** to definitive care.

Previously, the response to active shooter situations centered on the concept of “surround and contain.” The current response is more aggressive, focusing on providing faster care to victims. Individual officer trauma kits make this type of response possible. For example, as law enforcement professionals work to subdue the shooter, they can distribute the kits to uninjured bystanders who can then assist in treating victims with life-threatening injuries. Furthermore, these kits allow law enforcement officers to quickly treat injuries before transport to further medical intervention can occur.

Some agencies may be concerned that if law enforcement officers attempt to treat victims while responding to an active shooter situation, it would detract from their more traditional law enforcement responsibilities, such as subduing the shooter. However, recent events have shown that this may not be the case. In June 2015, an assailant opened fire on the Dallas Police Department's headquarters with automatic weapons and improvised explosive devices (IEDs). In responding the event, law enforcement officers were able to successfully deter the suspect, respond to suspicious packages, evacuate civilians, and treat the wounded. Because of their efforts, the only life lost was the life of the perpetrator.

## 2. TECHNOLOGY OVERVIEW

---

The number and type of components included in individual officer trauma kits varies. The Hartford Consensus III recommends the following four items be included in these kits when responding to an active shooter incident:

- Gloves
- Tourniquet
- Pressure bandage
- Hemostatic dressing.

These materials recommended for inclusion include tools aimed at prolonging life between the time the penetrating trauma occurs and intervention at a medical facility. Additional components found in the kits may include cloth tape for securing bandages, a nasopharyngeal airway (NPA) for securing a victim's airway, a face shield for the safe administration of cardiopulmonary resuscitation (CPR), chest seals to close penetrating chest wounds, and trauma shears to cut through fabric to expose an injury. Components may be available as options if not included in the original kit, and some kits are customizable to fit an agency's needs. Examples of individual officer trauma kits are shown in Figure 2-1 and Figure 2-2.

In addition to the included components, the size and portability of the kits, as well as training requirements, are some factors to consider when procuring individual officer trauma kits for law



**Figure 2-1. Individual Patrol Officer Kit (IPOK<sup>®</sup>), North American Rescue LLC**

*Image courtesy of North American Rescue LLC*



**Figure 2-2. Tactical Operations (TACOPS<sup>®</sup>) Kit, TSSi**

*Image courtesy of TSSi*

enforcement officers. Striking a balance between these factors is important and may also affect costs, especially when equipping an entire department.

## 2.1 Gloves

Gloves (Figure 2-3) are a critical component of any trauma kit. Gloves protect the wearer from contact exposure to pathogens and assist in preventing the introduction of contaminants into a patient's wounds. There are two main types of gloves available: latex and nitrile. Previously the glove of choice, latex gloves have become less popular due to an increase in the number of individuals with latex allergies. Nitrile gloves are becoming a more popular choice due to their ability to provide the necessary barrier protection and durability without causing an allergic reaction.



**Figure 2-3. Gloves**

*Image courtesy of North American Rescue*

## 2.2 Tourniquets

Tourniquets work to stop continuous blood flow. This is accomplished by placing a tourniquet proximal to the wound and tightening it, as illustrated in Figure 2-4.

Although this technology is long-established, the use of tourniquets was not considered advisable before 2001 because of the risk of limb amputation. However, during the conflicts in Afghanistan and Iraq, tourniquets, when used correctly, were shown to decrease the number of deaths related to extremity hemorrhage by 67 percent.

Tourniquets can be made from many different materials, and if necessary, can be made from improvised materials, such as a pressure bandage or a belt. The tourniquets found in these kits can be applied during high-stress situations with one hand. In addition, they have been proven to be effective in occluding blood flow in both upper and lower extremities.

In recent years, one of the main brands of tourniquets, Combat-Application-Tourniquet<sup>®</sup> (CAT), found in many individual officer trauma kits has been counterfeited. The U.S. Food and Drug Administration (FDA) issued a safety alert for the Element Airsoft CAT (E-CAT). The FDA noted that there are small differences in stitching, logo printing, and plastic pieces. These differences, though small, were shown to have catastrophic results when the E-CATs were used to try to control bleeding. Preliminary testing showed that the windlass, the portion of the tourniquet used to tighten the device, “breaks or bends before necessary forces can be applied to stop blood flow.” Some of the noticeable differences between the authentic CAT and the counterfeit E-CAT are illustrated in Figure



**Figure 2-4. Application of a Tourniquet**

*Image courtesy of and copyright of Phil Durango LLC*



**Figure 2-5. Packaging Comparison Between a CAT and an E-CAT**

*Image courtesy of and copyright of Phil Durango LLC*

2-5, Figure 2-6, and Figure 2-7. These counterfeit tourniquets are not sold in pre-assembled kits, but emergency responders should ensure that genuine components are purchased when customizing these kits for their agency.



**Figure 2-6. Windlass Comparison Between a CAT and an E-CAT**

*Image courtesy of and copyright of Phil Durango LLC*



**Figure 2-7. Band Comparison Between a CAT and an E-CAT**

*Image courtesy of and copyright of Phil Durango LLC*

### 2.3 Pressure Bandages

Pressure bandages, also known as pressure dressings, emergency trauma dressings, or Israeli dressings, have long been included in trauma kits. An example of a pressure bandage is shown in Figure 2-8.

Pressure bandages are made up of three layers:

- A sterile non-adhesive bandage that is placed against the skin
- A bulky, absorbent material that comprises the middle layer
- A stretchable adhesive outer layer.



**Figure 2-8. Pressure Bandage**

*Image courtesy of North American Rescue*

In trauma situations, pressure bandages can be placed directly on a wound to cover it and absorb fluid. The stretchable adhesive layer resembles an elastic bandage used for treating sprained joints. This layer helps localize and keep pressure on the wound, thus slowing or stopping blood flow. Pressure bandages can also be used as improvised tourniquets.

### 2.4 Hemostatic Dressings

Developed shortly after the onset of the conflicts in Iraq and Afghanistan, hemostatic agents work to quickly stop hemorrhaging and lower the chance of hemorrhaging again after bleeding is

stopped. Currently, there are two main types of hemostatic agents found in individual officer trauma kits: kaolin-based and chitosan-based. The most widely used application of hemostatic agent is combat gauze (CG). CG is a dressing made of synthetic fiber saturated with either type of hemostatic agent. When used, CG is packed into a wound and the hemostatic agent in the material aids in stopping the bleeding.



**Figure 2-9. Kaolin-based Combat Gauze**

*Image courtesy of Z-Medica*



**Figure 2-10. Chitosan-based Combat Gauze**

*Courtesy of HEMCON*

Kaolin-based hemostatic dressings work by initiating and accelerating the clotting process. An example of kaolin-based CG is shown in Figure 2-9. Chitosan-based hemostatic dressings work by adhering to tissues and sealing the injury. An example of chitosan-based CG is shown in Figure 2-10.

A third type of hemostatic agent, zeolite, is still on the market in limited quantities; however, it is not typically included in individual officer trauma kits. Zeolite-based hemostatic agents work by absorbing water, concentrating the natural coagulants in the body, and thus accelerating blood coagulation. This hemostatic agent also produces a significant exothermic reaction, potentially causing unnecessary tissue damage.

## 2.5 Additional Components

Additional items that may be found in individual officer trauma kits include cloth tape, an NPA, a face shield, chest seals, and trauma shears. Cloth tape (Figure 2-11) is a multifunctional tool used in many different medical settings. For example, cloth tape can be used to splint injuries and adhere bandages. An NPA (Figure 2-12) is a tube placed through the nose, creating a conduit to the pharynx and thus securing the airway. A face shield (Figure 2-13) is a one-way valve that permits the user to perform CPR without making contact with potentially harmful bacteria. Chest seals (Figure 2-14) are adhesive dressings used to cover and occlude penetrating chest wounds. Trauma shears (Figure 2-15) are used to cut through fabric to expose injuries. Trauma shears appear similar to standard scissors; however they are angled 150 degrees and have a blunt edge.



**Figure 2-11. Cloth Tape**

*Image courtesy of 3M*



**Figure 2-12. NPA**

*Image courtesy of planet.tvi.edi*



**Figure 2-13. Face Shield**

*Image courtesy of CPR Savers*



**Figure 2-14. Chest Seals**

*Image courtesy of Chinook Medical Gear*



**Figure 2-15. Trauma Shears**

*Image courtesy of North American Rescue LLC*

## **2.6 Size and Portability**

The size and portability of individual officer trauma kits are important factors because these kits should be within an officer's reach in the event they need to be used. Many kits are small enough to be comfortably worn on an officer's belt or vest, or carried inside a pocket. Holsters, clips, or webbing on the kit may provide alternate attachment options. The more components in a kit, the larger the kit tends to be. Larger kits may be too obtrusive to wear, and an officer may opt to stow the kit in a vehicle or bag instead. While this may work in most instances, there could potentially be cases where a traumatic injury occurs and the officer is nowhere near their vehicle or bag to retrieve the kit. An agency might develop a policy regarding where the kits should be stowed so they are in the same location for every officer. Further, an agency may consider storing additional kits in a designated location, enabling bystanders to render aid if needed.

## **2.7 Training**

Although it is common for law enforcement officers to be trained in the dangers of blood borne pathogens and in performing first aid techniques, such as CPR, often an agency's minimum medical training requirements stop there. Consequently, additional medical training may be required to ensure officers understand how to safely and properly treat traumatic injuries using items provided in individual officer trauma kits. For example, knowing where to place tourniquets and how to bandage wounds and use chest seals are some of the areas where additional training may be necessary. While some kits may require minimal training, more complex kits will likely necessitate more comprehensive training.

In addition to training law enforcement officers, agencies may consider working to educate the public in case bystanders are able to safely lend a hand during an active shooter incident. There are several organizations that offer active shooter response training with instruction on treating traumatic injuries. Table 2-1 lists some of the organizations that provide this type of training for law enforcement officers and/or the public.

**Table 2-1. Active Shooter Trainings**

| Organization   | First Responders | Public | Website  |
|--|------------------|--------|--|
| Advanced Law Enforcement Rapid Response Training (ALERRT) Center | ✓                |        | <a href="http://www.alerrt.org">www.alerrt.org</a>   |
| Department of Homeland Security (DHS)                            | ✓                | ✓      | <a href="http://www.dhs.gov/active-shooter-preparedness">www.dhs.gov/active-shooter-preparedness</a> |
| Federal Emergency Management Agency (FEMA)                       |                  | ✓      | <a href="http://www.training.fema.gov">www.training.fema.gov</a>                                     |

**2.7.1 First Responder**

One of the challenges of any new technology and its application is training. For the emergency medical services (EMS) and fire/rescue community, first aid instruction is built into their training. However, for law enforcement officers, first aid training may be limited. As trauma kits become more complex, more education may be necessary to teach first responders how to properly use an individual officer trauma kit. This additional education could come in the form of slight modifications to existing training methods to include effective external hemorrhage control. The Hartford Consensus III recommends that any training program for professional first responders include how to do the following:

- Ensure personal safety
- Coordinate efforts with all other responders
- Communicate among all other responders
- Properly interact with immediate responders
- Apply the principles of THREAT
- Apply direct pressure
- Use hemostatic dressings
- Use tourniquets.

**2.7.2 Public**

Education for the public could come in the form of training courses or advertising through public service announcements, billboards, and print advertisements. As advised in the Hartford Consensus III, “the public needs to be empowered to engage in lifesaving actions.” The Hartford Consensus III also suggests that any public education program include how to do the following:

- Ensure personal safety
- Properly interact with professional first responders
- Identify life threatening bleeding
- Apply direct pressure
- Use hemostatic dressings
- Use tourniquets.

## **2.8 Cost**

Costs of individual officer trauma kits vary with the number and types of components included in the kit, ranging from under \$20 to over \$150 each. Agency size and additional training requirements also influence the total overall cost for an agency to equip their officers with individual officer trauma kits.

## **3. SUMMARY**

---

With the proper training, law enforcement officers equipped with individual officer trauma kits may be able to provide life-saving care for themselves or other victims of traumatic injuries until certified medical personnel arrive. Kits vary by the number and type of components, size, and portability, and additional medical training may be required so officers can properly use components in the kit to treat life-threatening injuries.

## APPENDIX A. REFERENCES

---

Alam, H. B., Burris, D., and DaCorta, J. A. *Hemorrhage Control in the Battlefield: Role of New Hemostatic Agents*. <http://publications.amsus.org/doi/pdf/10.7205/MILMED.170.1.63>. Accessed September 17, 2015.

Anderson, Scott. *Nasal Pharyngeal Airway*. <http://centegra.org/wp-content/uploads/2013/06/Nasal-Pharyngeal-Airway.pdf>. Accessed September 17, 2015.

Arnaud, F., Breadling, Burris, D., C., Carr, W., Delima, M., Govindaraj, K., Lutz, C., McCarron, R., McKeague, A., McNamee, G., Mog, S., Parreño-Sadalan, D., Sharp, T., Teranishi, K., and Toshiki, T. *Comparison of 10 Hemostatic Dressings in a Groin Transection Model in Swine*. [http://www.merplast.fi/celox/Published%20Papers/Comparison\\_of\\_10\\_Hemostatic\\_Dressings\\_in\\_a\\_Groin.28.pdf](http://www.merplast.fi/celox/Published%20Papers/Comparison_of_10_Hemostatic_Dressings_in_a_Groin.28.pdf). Accessed September 17, 2015.

Arnaud, F., Carr, W., McCarron, R., McKeague, A., Prusaczyk, K., Teranishi, K., and Tomori, T. *Exothermic Reaction in Zeolite Hemostatic Dressings: QuikClot<sup>®</sup> ACS and ACS+<sup>®</sup>*. <http://link.springer.com/article/10.1007%2Fs10439-008-9543-7>. Accessed September 17, 2015.

Austin, P. N., Gegel, B. T., and Johnson, A. *An Evidence-Based Review of the Use of Combat Gauze (QuikClot) for Hemorrhage Control*. <http://www.aana.com/newsandjournal/Documents/evidenced-based-review-1213-p453-458.pdf>. Accessed September 17, 2015.

Butler, F. K., Holcomb, J. B., and Rhee, P. *Hemorrhage control devices: Tourniquets and hemostatic dressings*. <https://www.facs.org/~media/files/publications/bulletin/hartford%20consensus%20compendium.ashx>. Accessed September 17, 2015.

Butler, F. K. *Military history of increasing survival: The U.S. military experience with tourniquets and hemostatic dressings in the Afghanistan and Iraq conflicts*. <https://www.facs.org/~media/files/publications/bulletin/hartford%20consensus%20compendium.ashx>. Accessed September 17, 2015.

Carmona, Richard H. *Public health education: The use of unique strategies to educate the public in the principles of the Hartford Consensus*. <https://www.facs.org/~media/files/publications/bulletin/hartford%20consensus%20compendium.ashx>. Accessed September 17, 2015.

Eastman, Alexander L. *The continuing threat of active shooter and intentional mass casualty events: Local law enforcement and hemorrhage control*. <https://www.facs.org/~media/files/publications/bulletin/hartford%20consensus%20compendium.ashx>. Accessed September 17, 2015.

Federal Bureau of Investigation. *A Study of Active Shooter Incidents in the United States Between 2000 and 2013*. <https://www.fbi.gov/news/stories/2014/september/fbi-releases-study-on-active-shooter-incidents/pdfs/a-study-of-active-shooter-incidents-in-the-u.s.-between-2000-and-2013>. Accessed September 17, 2015.

Federal Bureau of Investigation. *Active Shooter Incidents*. <https://www.fbi.gov/about-us/office-of-partner-engagement/active-shooter-incidents>. Accessed September 17, 2015.

Jacobs Jr., L.M., McSwain, N., Rotondo, M., Wade, D., Fabbri, W., Eastman, A., Butler, F., and Sinclair, J. *Improving Survival from Active Shooter Events: The Hartford Consensus*. [http://www.naemt.org/files/lefrtcc/hartford\\_consensus.pdf](http://www.naemt.org/files/lefrtcc/hartford_consensus.pdf). Accessed September 16, 2015.

Jacobs Jr., Lenworth M. *Joint Committee to Create a National Policy to Enhance Survivability from Mass Casualty Shooting Events: Hartford Consensus II*. <http://www.naemt.org/Files/LEFRTCC/Hartford%20Consensus%20Call%20to%20Action.pdf>. Accessed September 16, 2015.

Jacobs Jr., Lenworth M. *The Hartford Consensus III: Implementation of Bleeding Control*. <http://bulletin.facs.org/2015/07/the-hartford-consensus-iii-implementation-of-bleeding-control/>. Accessed September 16, 2015.

Kaimal, A. J., Philip, J. H., and Greenber, J. A. *How Much Pressure Does a Pressure Dressing Press? A Pilot Study Quantifying the Effects of a Pressure Dressing on the Post-Cesarean Section Incision*. <http://www.woundsresearch.com/article/5468>. Accessed September 17, 2015.

Kragh Jr., J. F., Littrel, M. L., Jones, J. A., Walters, T. J., Baer, D. G., Wade, C. E., and Holcomb, J. B. *Battle Casualty Survival with Emergency Tourniquet Use to Stop Limb Bleeding*. [http://ac.els-cdn.com/S0736467909006386/1-s2.0-S0736467909006386-main.pdf?\\_tid=9d3a901a-66ee-11e5-943f-00000aacb360&acdnat=1443561253\\_d686965ef4d561b6bb4c040cf488876b](http://ac.els-cdn.com/S0736467909006386/1-s2.0-S0736467909006386-main.pdf?_tid=9d3a901a-66ee-11e5-943f-00000aacb360&acdnat=1443561253_d686965ef4d561b6bb4c040cf488876b). Accessed September 17, 2015.

Littlejohn, L.F., Devlin, J. J., Kircher, S. S., Lueken, R., Melia, M. R., and Johnson, A. S. *Comparison of Celox-A, ChitoFlex, WoundStat, and Combat Gauze Hemostatic Agents Versus Standard Gauze Dressing in Control of Hemorrhage in a Swine Model of Penetrating Trauma*. <http://onlinelibrary.wiley.com/doi/10.1111/j.1553-2712.2011.01036.x/epdf>. Accessed September 17, 2015.

Mahadevan, Swaminatha. *An Introduction to Clinical Emergency Medicine*. Accessed September 17, 2015.

Stuke, Lance E. *Prehospital topical hemostatic agents – A review of the current literature*. [https://www.naemt.org/docs/default-source/trauma-resources/Prehospital\\_Topical\\_Hemostatic\\_Agents.pdf?sfvrsn=2](https://www.naemt.org/docs/default-source/trauma-resources/Prehospital_Topical_Hemostatic_Agents.pdf?sfvrsn=2). Accessed September 17, 2015.

U.S. Food and Drug Administration. *Combat Application Tourniquets (C-A-T): Suspected Counterfeit Product*. <http://www.fda.gov/Safety/MedWatch/SafetyInformation/SafetyAlertsforHumanMedicalProducts/ucm221752.htm>. Accessed September 17, 2015.

## **APPENDIX B. ACRONYMS**

---

|        |   |
|--------|---|
| ACS    | American College of Surgeons                              |
| AEL    | Authorized Equipment List                                 |
| ALERRT | Advanced Law Enforcement Rapid Response Training          |
| CAT    | Combat-Application-Tourniquet                             |
| CG     | combat gauze  |
| CPR    | cardiopulmonary resuscitation                             |
| DHS    | Department of Homeland Security                           |
| E-CAT  | Element Airsoft Combat-Application-Tourniquet             |
| EMS    | emergency medical services                                |
| FBI    | Federal Bureau of Investigation                           |
| FDA    | U.S. Food and Drug Administration                         |
| FEMA   | Federal Emergency Management Agency                       |
| IEDs   | improvised explosive devices                              |
| INL    | Idaho National Laboratory                                 |
| NPA    | nasopharyngeal airway                                     |
| SAVER  | System Assessment and Validation for Emergency Responders |
| S&T    | DHS Science and Technology Directorate                    |