



**Homeland
Security**

Science and Technology

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

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 operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

Information provided by the SAVER Program will be shared nationally with the responder community providing life- and cost-saving assets to federal, state, and local responders.

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, please see the SAVER Web site or contact the SAVER Program Support Office.

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TechNote

Counter-IED Technologies

On February 12, 2007, President George W. Bush signed Homeland Security Presidential Directive 19 (HSPD-19) which deals exclusively with combating the domestic use of improvised explosive devices (IEDs). This directive defines an IED as "an explosive device that is fabricated in an improvised manner incorporating explosives or other destructive, lethal, pyrotechnic, or incendiary chemicals." Essentially, an IED is a bomb made with readily available materials intended to either disable or destroy personnel and/or equipment. While the task of rendering IEDs safe is typically handled by trained professionals, emergency responders should be familiar with the technologies involved in countering IEDs.

IED Characteristics

IEDs can take many forms and can range from something as small as a 2-inch long pipe bomb to a truck filled with fertilizer. IEDs generally have four main components as shown in Figure 1. These components can be remembered using the acronym, PIES: a power supply, an initiator, an explosive, and a switch.

The explosive can be homemade (referred to as an HME), commercial, military grade, or a combination. Explosives are classified as primary, secondary, or tertiary by how easily they explode. A primary explosive is very unstable and can be detonated by a sharp knock, a secondary explosive usually requires a blasting cap or other initiator, and a tertiary explosive usually can only be detonated through the use of an initiating explosion. TNT and C4 are examples of secondary explosives and ammonium nitrate (fertilizer bomb) is an example of a tertiary explosive. In addition, ballistic material such as ball bearings or screws may be included in the explosive to maximize damage.

The initiator is a device that causes the IED to explode. Depending on the nature of the explosive, the initiator can take many forms. It may be a spark generating device, a commercial or military-style blasting cap, or a secondary explosive, as would be needed with a tertiary explosive.

Anything that sets off the initiator, usually from a safe distance, can be used as a switch. Wireless devices, such as cell phones, key fobs, and walkie-talkies, are often used. Wired triggers are also common and include timers, trip-plates, wired or infrared (IR) trip wires, and IR lasers.

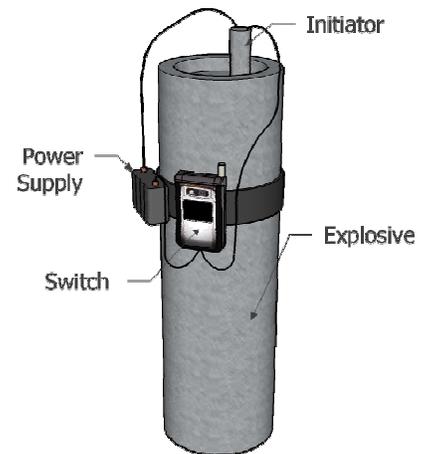


Figure 1.
Components of an IED

Most IEDs contain a power supply, usually in the form of batteries, which may be integrated into the switch. This component provides the necessary energy to the initiator and may power the switch. If an IED does not have a power supply, the initiator is triggered by a mechanical switch, such as a spring loaded mechanism.

This wide range of possible configurations makes IEDs particularly difficult to detect and disarm.

Counter-IED

Detecting the presence of a potential IED is an important first step in rendering it safe and is the step most likely to involve emergency responders. After the identification of a potential IED, counter-IED (C-IED) technologies involve interfering with one of the IED's components. These technologies operate by either defeating the device or mitigating its effect.

Detect

An IED can be housed in any common object large enough to hide the device, including a suitcase, a van, or a backpack. There is no sure sign that a package or vehicle contains an IED. Some signs to look for include an abandoned suitcase or package, the absence of a normally present group of people, or a car heavily weighted down. Because IEDs frequently use traditional explosives, bomb-sniffing dogs can often be used to detect the presence of an explosive component. This, however, requires close proximity to the suspected device.

If an IED is suspected, the local bomb squad or explosive ordnance disposal (EOD) personnel should be contacted. Agents from these organizations are trained in the disposal of bombs, including IEDs, and can provide the area commander an assessment of the situation and the support needed to render safe an IED.

Defeat

Defeating IEDs usually requires interfering with the triggering or detonation systems of the device. If the device is controlled through a radio-frequency (RF) link, such as a cell phone or walkie-talkie, electronic countermeasures are usually employed. This typically involves using some sort of jamming technology. Jamming involves the transmission of a signal at the same frequency as the triggering signal, thus causing interference with the triggering signal and preventing it from initiating the detonation.

The three common methods of jamming are barrage, spot, and sweep jamming. Barrage jamming transmits across a broad range of frequencies, but with fairly little power dedicated to any one frequency, thus

limiting its range. Spot jamming involves generating a single interfering frequency. As all of the transmitter power is dedicated to one specific frequency, spot jamming has a larger range than barrage jamming but is limited to situations where the triggering frequency is known in advance. Sweep jamming involves rapidly sweeping through a range of frequencies. This type of jamming is not as effective as spot jamming, but has the advantage of being able to interfere with a broad frequency range.

One potential issue with C-IED electronic countermeasures is that they interfere with RF communications within their effective frequency and distance range. Some radios and cell phones may be rendered inoperable within the effective range.

There are also possible legal ramifications to interfering with RF signals. As of 2008, based on the 1934 Communications Act, the FCC does not permit the sale or lease of RF jamming equipment except to federal agencies.

Mitigate

Mitigating an IED involves minimizing the potential damage inflicted by the device upon detonation. When the presence of an IED is known or suspected, active mitigation procedures may include the removal of all non-essential personnel from the area and intentional detonation of the IED. Detonation can be accomplished using high-power lasers or robots.

Conclusion

IEDs have been used extensively by guerilla and terrorist groups throughout the world, and there is increasing concern over domestic IED attacks. Due in large part to the wars in Afghanistan and Iraq, C-IED technology has advanced significantly in the last decade. While domestic C-IED activities will be handled by specialists, emergency responders should be aware of the technologies a bomb squad would use to help render IEDs safe.

Additional Resources

Office for Domestic Preparedness Training Brief
<https://www.llis.dhs.gov/docdetails/details.do?contentID=27239>

Global Security
<http://www.globalsecurity.org/military/intro/ied.htm>

Homeland Security Presidential Directive 19
<http://www.whitehouse.gov/homeland/hspd19/>

Joint Forces Quarterly Article on Domestic IEDs
http://www.ndu.edu/inss/Press/ffq_pages/editions/i48/18.pdf