HEALTH & PUBLIC SAFETY COMMITTEE MEETING

January 17, 2008

Prepared by: Nelson Diaz

EXHIBITS LIST

NO.	DATE	ITEM #	DESCRIPTION
1	1/17/2008		Memorandum from Commissioner Souto Re: Absence
2	1/17/2008		Memorandum from Commissioner Diaz Re: Absence
3	1/17/2008		Report Entitled: A Study on the Effects of Tasers on Humans, dated September 2007
4	1/17/2008		PowerPoint Presentation Entitled: Police Executive Research Forum: A Study on the Effects of Tasers on Humans
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SENATOR JAVIER SOUTO
COMMISSIONER

MEMORANDUM

TO:	The Honorable Dennis Moss, Chairperson and Members Health and Public Safety Committee
FROM:	Sen. Javier Souto
DATE:	January 14, 2008
RE:	Absence from Meeting - January 17, 2008

I will be unable to attend the meeting due to the fact that I will be out of the country from January 13th to the 17th on an International Economic Mission for Miami Dade County.

I will return to my usual activities as soon as I get back.

cc:
The Honorable Rebeca Sosa
The Honorable Jose "Pepe" Diaz
The Honorable Carlos Gimenez
The Honorable Sally Heyman
Kay Sullivan, Clerk of the Court ✓

COMMISSIONER JOSE "PEPE" DIAZ

DISTRICT 12

MEMORANDUM

TO: Honorable Dennis C. Moss, Chairperson
Health and Public Safety Committee

FROM: Commissioner Jose "Pepe" Diaz

DATE: January 17, 2008

RE: Absence

Please be advised that I will not be able to attend today's Health and Public Safety Committee meeting.

I apologize for any inconvenience this may cause.

JPD/mlc

c: Clerk of the Board

Executive Summary

Since its inception, the Conducted Energy Device (CED) or Taser™ has provided police agencies with a unique tool to temporarily incapacitate aggressive subjects. Delivering 50,000 volts of electricity at relatively low power (18-26 watts), the device can be used either in "probe" or "touch stun" mode. In the "probe" mode, the device fires barbs and their trailing wires out of the hand-held unit. The electrical current causes the subject's muscles to contract, rendering the person immobile. In "touch stun" mode, the electrical contacts on the hand-held unit are pressed directly onto the subject; there is a similar but reduced neuromuscular effect compared to the "probe" mode. The use of CEDs has the potential to reduce officer and suspect injuries that would normally occur when officers go "hands-on" to control and apprehend a suspect. The device has proved popular among police officials who are searching for less-lethal weapons; as of this writing, more than 11,000 law enforcement agencies in the United States use Taser devices.

However, the CED is not without controversy. Civil rights groups such as the ACLU have expressed concern that Tasers, if misused, can be used as torture devices, and that their use has been said to have contributed to in-custody deaths.

Some research has been conducted in the United States regarding CED use and associated risks. This report presents information about the physiological effects of CED use, examines available data on their effectiveness, and finally reviews how the news media have portrayed their use.

While research in some aspects has been limited, the physiologic effects of CED use have been found to be minimal and to generally subside once the electrical discharge is halted. Most in-custody deaths that involved the use of a CED, according to studies, were the result of excited delirium. Additionally, medical studies revealed that many injuries are caused when persons fall down after being subjected to a CED activation. While CEDs pose little risk to healthy adults, there have been no formal human tests on the use of CEDs on the elderly, children, and those under the influence of drugs or alcohol.

Based on the available data, the Taser device appears to reduce injuries to officers and suspects. According to research conducted by Smith et al., use of the Taser in Miami Dade has resulted in a 67-percent decline in the likelihood of officer injury and an 87-percent reduction in the likelihood of suspects being injured.

In a study of stories about CED use in major newspapers in 2006, approximately 75 percent of the articles examined noted that the person activated by a CED was under the influence of drugs and/or alcohol. In more than 40 percent of the cases, reference was made to the fact that the suspect was armed, the majority being armed with a handgun. The gravest myth surrounding Taser use is the belief that Tasers cause ventricular fibrillation (VF) or death by electrocution, followed by the belief that being hit with a Taser affects a pacemaker, all of which are untrue, as explained in this report. Deaths occurring in proximity to the use of a Taser are far less common than is portrayed by the media, but understandably receive more attention, giving the public the impression that Tasers are more dangerous than they actually are. Most of the articles examined, however, express neutral attitudes toward Taser use, and make clear that when the Tasers were used, there were minimal, if any, injuries.

Conclusion: While many agencies credit CED use with decreased injuries to suspects as well as officers, more studies need to be conducted on the medical consequences of Taser use, especially in regard to certain groups, such as children and the elderly. Additionally, there is a need for studies of the impact that CED deployment by a police agency has on use-of-force incidents, particularly injuries to officers and suspects. Based on current available research, CEDs appear to provide greater safety for officers, suspects, and the public.

A Study on the Effects of Tasers on Humans

September 2007

POLICE EXECUTIVE
RESEARCH FORUM

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Introduction

Law enforcement officers are legally authorized to use force, including deadly force, in carrying out their mandate to preserve order, enforce the law, and protect lives. Over the last several decades, there have been substantial improvements in less-lethal methods of defense and control. One such method is the use of Conducted Energy Device (CED) technology, which delivers an electrical current in order to subdue and incapacitate a person. Although there are numerous CED manufacturers, TASER International, Inc. has an almost exclusive share of the market. Currently, more than 11,000 law enforcement agencies in the United States use TASER® devices.[1] As the frequency of CED use increases, so do questions regarding the safety of these devices and concerns about possible misuses. Several groups, such as the ACLU, have raised concerns that custodial deaths occurring in proximity to a CED may have been the direct result of its use. However, few scientific studies have been published concerning the use of CEDs.

This comprehensive report will review what is known about CEDs generally and Tasers specifically. It will include a discussion of the history and design of CEDs, and a description of how they work in theory and in practice. Attention will then be given to their impact on the body, including how CEDs can be used in a variety of modes and cycles. The report will then present medical data on how CEDs work on the human body, both psychologically and physiologically. Available data on the success and failures of CEDs will be examined, with an emphasis on deaths related to CED use. Finally, this report will examine how the news media have portrayed CEDs and use of force. The report will provide further understanding of CEDs and how they can be implemented with the goal of ensuring the highest levels of safety and success.

Overview of the TASER®

The use of electricity has a long history for controlling animals (electronic fences and shock collars) and for inflicting pain on humans (i.e., the "Tucker telephone," a torture device made from an old-fashioned crank telephone and named for a prison in Arkansas where it was used, and the electric shock baton, similar to a cattle prod). Until the mid-1970s, there had never been a legitimate law enforcement application of electricity to control suspects. Perhaps in response to the need for an alternative intermediate weapon for law enforcement, NASA scientist Jack Cover invented a device that looked like a flashlight (the TASER TF-76) that fired two darts up to a distance of 15 feet and sent a shock to the body. TASER stands for the Thomas A. Swift Electric Rifle, named after a similar device described in a series of adolescent adventure books launched in 1910 and published under the name Victor Appleton.

The darts from the TASER TF-76 were propelled from the hand-held unit but remained connected by thin, insulated wires. The original TF-76 launched the darts with a gunpowder propellant and was classified as a firearm by the Bureau of Alcohol, Tobacco and Firearms because of the explosive propellant. The TF-76 was classified as a Title 2 weapon, the same classification as a "sawed-off" shotgun. This meant that the TASER TF-76 could only be sold to those who secured expensive and difficult-to-obtain licenses. This classification doomed the commercial success of the TF-76, and the company collapsed.

After several years of development and fundraising, a new company, Tasertron, sold a limited number of the electronic devices to law enforcement agencies. Tasertrons were originally sold in seven-watt, and then 11-watt, configurations.

In the early 1990s, ICER Corporation and then AIR TASER, Inc. were formed by two brothers, Rick and Thomas Smith, along with Jack Cover. They developed the AIR TASER 3400 that debuted in late 1994. This model was similar to the earlier devices, but the darts were propelled by compressed air. This new propulsion system complied with federal firearm statutes and allowed for sales to citizens as well as the law enforcement community. The AIR TASER 3400 included a new technology called AFID (Anti-Felon Identification), which dispersed small pieces of colored confetti showing the serial number of the cartridge any time the device was fired, in order to provide accountability for the firing of the TASER.

These early electronic devices were powerful, but their shock was insufficient to immobilize a suspect. In fact, in repeated trials suspects were able to fight through the electronic shock. In 2000, the company, which had changed its name to TASER International, Inc., began distributing the Advanced TASER M26, which was developed to impair muscular control of the subjects and render them helpless by inducing significant, uncontrollable muscle contractions. The new technology was called Electro-Muscular Disruption (EMD), a name that later was changed to Neuromuscular Incapacitation (NMI).

The TASER M26 is a battery-operated device that generates a high-voltage (50,000 volts), relatively low-power (18-26 watts) electrical current that is transmitted by a cartridge attached to the front end of the weapon. The cartridge contains two barbs (electrodes) that are attached to a coiled length of wire ranging from 15- 35 feet. When the device is fired, the barbs are propelled towards the subject, pulling the wires behind them, and they attach themselves to the skin or clothing of the targeted individual. When the barbs strike a person, a current is sent down the wires and through the person's body between the two barb points. The electricity flows in a series of pulses (that are heard as 'clicks'). If the M26 batteries are weak due to a cold environment or because they need replacement, the frequency of these pulses may be reduced, rendering the device less effective.

Tasers can be used either in "probe" or "touch stun" mode. In the "probe" mode, the device fires the barbs and their trailing wires out of the hand-held unit. The Taser can be fired once before a new cartridge needs to be reloaded. Once the barbs are connected to a suspect, the electrical current can be sent in five-second intervals by pulling the trigger (the electricity can be stopped at any time with a safety switch). Tasers can be used in "touch stun" mode after firing or when there is no cartridge. In this mode, the electrical contacts on the hand-held unit are pressed directly onto the subject. However, as the electrodes are approximately 50mm apart, using the Taser in this fashion is unlikely to provide the same incapacitation effect as probe mode, because fewer muscles are affected. Each Taser cartridge has its own serial number and releases up to 40 pieces of AFID confetti. The M26 incorporates a data port that records the time and date of every trigger pull, up to 585 times.

A Taser introduces electrical current into the body of the subject. This current passes through the skin and follows the nerve pathways through nerve fibrils or cells and their myelin sheaths, which are both excellent conductors of electricity. The current then continues through the nerve endings or synapses which are attached to the muscles. The electrical charge to the muscle's cells causes them to contract in an abnormal, titanic or sustained way which has the effect of immobilizing the suspect by not allowing him or her to make voluntary movements.

The M26 Taser looks like a pistol and is carried in a holster similar to a police officer's firearm holster. It is powered by eight AA batteries and is equipped with an ambidextrous safety switch, which also arms the weapon. A bottom-mounted laser site is activated when the weapon is armed.

In December 2003, "Shaped-Pulse Technology" was introduced in a new model labeled the X26. The new pulse technology enabled the design of the X26 to be 60 percent smaller and 60 percent lighter than the M26, yet it delivers an incapacitating shock that causes muscular contractions 5 percent stronger than those of the M26. The appearance of the X26, like the M26, is that of a pistol, and it uses the same cartridge. The X26's power comes from a Lithium power cell rather than conventional batteries. The X26 uses less wattage to incapacitate the subject (7 to 11 watts, compared to the 18 to 26 watts of the M26). Furthermore, it incorporates a digital pulse controller that creates a more "consistent" flow of energy than the older model. When the trigger of the X26 is held, the weapon delivers a burst of electrical energy at 19 pulses per second for the first two seconds and then 15 pulses per second after that. The electrical discharge stops when the trigger is released.

The data port on the X26 records time/date/duration of cycle, unit temperature, and battery status. When the safety is positioned upward to arm the weapon, there is a light emitting diode display that informs the user of the Taser's status. The central information display (CID) shows the percentage of power remaining for five seconds, and displays two dots to indicate the weapon remains armed. In addition, TASER has developed the Extended Range Electro-Muscular Projectile, or XREP, that could work at greater distances than the 35-foot maximum range of the X26 and M26. This wireless 12-gauge Neuromuscular Incapacitation (NMI) projcctile weighs only half an ounce. TASER International, Inc. plans to begin a six- to 12-month field trial of the XREP in the fall of 2007. Once testing is complete, release of the product is scheduled for 2008.

In 2006, the Less Lethal Technology Working Group, a panel sponsored by the U.S. Dcpartment of Justice, agrccd to rcfer to TASER-type weapons as Conducted Energy Devices (CED). The Less Lethal Technology Working Group was composed of members of the Police Executive Research Forum (PERF); the International Association of Chiefs of Police; the Commission on Accreditation for Law Enforcement Agencies; the Major City Chiefs Association; the National Sheriffs' Association; the Fraternal Order of Police; Montgomery County, MD Police Department; the Police Foundation; and the National Organization of Black Law Enforcement Executives; along with members of DOJ's Bureau of Justice Assistance, National Institute of Justice, and the Office of Community Oriented Policing Services.

According to TASER International, CEDs have been activated on more than 100,000 volunteers during training sessions without complications, and have been deployed by police on more than 150,000 subjects during actual confrontations.[1] These figures have not been independently confirmed.

Medical Effects of CED Use

Background on Excited Delirium and Sudden Death in Custody

A major issue pertaining to CED use is the number of subjects who have died after CED use while in custody. Sudden Death in Custody Syndrome has been an issue in the medical literature for years and has been the subject of numerous lawsuits. For decades, subjects of police intervention have died after being maximally restrained on their stomachs, on their sides, while sitting, or while in ambulances with medical care immediately available. They have died after OC spray use, with and without weight on their backs, and now after CED use.[2-12]

The common link in these deaths does not appear to be the specific actions by the police, but rather the physiologic state of the individual at the time of police intervention. In reviewing the literature and individual case reports and autopsies, it appears that most of these subjects were suffering from what is termed "excited delirium." This is a physiologic state that goes beyond simple drug intoxication and results in an individual being more out of control. They are often sweating, hyperactive, hallucinating, experiencing a rapid heart rate, and/or feeling increased strength and less perception of pain. Frequently they are destructive. Additionally, individuals with undiagnosed or under-treated psychiatric disorders, in particular schizophrenia or bipolar mania, are at risk for experiencing a state of excited delirium.

Police are often the first responders who are called when people are hallucinating or otherwise experiencing these symptoms in public. A state of excited delirium is associated with an increased risk of sudden death, regardless of which method police use to gain control of these individuals. A review by Stratton found an 11-percent death rate in individuals presenting symptoms of excited delirium to EMS providers.[4]

Previously, the concept of positional asphyxia from placing a subject in a prone maximal restraint (hogtie) position was implicated in causing deaths to subjects in custody.[13-15] However, there is physiologic evidence that people do not asphyxiate when left in a prone maximal-restraint position. Additional research has brought further doubts about the idea that positional asphyxia causes deaths, even when combined with exposure to OC spray or additional weight force transiently placed on the backs of individuals during the restraining process.[16-24] However, compression asphyxia, or the placement of a suspect on his stomach after he or she is controlled, remains a concern in law enforcement, and research findings have not been able to provide definitive answers to the complex questions of how such a position affects people under the influence of drugs or alcohol, or "excited delirium."

Literature Review: Physiologic Effects of CEDs on the Human Body

The following sections on the physiologic effects of CEDs refer to those devices with a probe-spread that is wide enough to cause muscle tetany (spasms) and incapacitation, as well as pain. Such CEDs cause electro-physical involuntary contraction of skeletal muscles and override the nervous system, resulting in loss of motor control by the subject. This incapacitation occurs regardless of the subject's mental focus, training, size, or state of drug intoxication.

During activation of a CED, the subject is often unable to voluntarily perform any motor task, yet remains conscious with full recall of the event. After the electrical discharge is halted, subjects are immediately able to perform at their cognitive and physical baseline, though some report mild fatigue and muscular soreness afterwards.

The exact effects of CEDs vary depending on the type of device being used, the location of the probes on the body and distance between the probes, and the physical condition of the subject. If the probe spread on the body is less than five centimeters, there will be a lower degree of effectiveness than if the probes are spaced more widely apart, allowing the electrical discharge to affect a larger portion of the subject's musculature.[25] The effectiveness of CEDs has been anecdotally reported to increase with the duration of application. A prolonged activation may result in muscle fatigue after the discharge is halted.[26]

Published medical research on the health effects and safety of CEDs in humans has been very limited. Until recently, most physiologic investigations have been conducted in animal models. The governmental regulatory approval of the original CED devices was not based on either human or animal studies, but on "theoretical calculations of the physical effects of dampened sinusoidal pulses," from which the U.S. Consumer Product Safety Commission concluded that the Taser should not be lethal to a normal, healthy person.[27] Understanding of the anatomic and physiologic effects of CEDs is critical to understanding their safety.

Muscular Effects

As previously described, CEDs create intense involuntary contractions of skeletal muscle, causing the subject to lose the ability to directly control the actions of voluntary muscles. This incapacitation is due to an electrical effect and stops a short time after the electrical discharge is halted. Residual muscle soreness is occasionally reported, but there are no known permanent effects on the muscular system beyond injuries that may result from an associated fall. It is possible that extensive muscle activity, as a result of agitation, struggle, or heavy exertion, along with the effect of a CED discharge on the muscles, could potentially increase the risk of rhabdomyolysis, a muscle tissue breakdown that can lead to kidney failure and other complications. However, the contribution of a CED to the development of rhabdomyolysis is likely minimal when only a few shocks are administered.[28]

Skin Effects

CEDs will often leave a mark at the site of probe contact. These so-called "signature marks" are of little medical consequence unless they hit a sensitive area such as the face, eyes, genitalia, or breast. These marks are in addition to the small puncture wounds that occur from the barbs' penetration of the skin. Unless they occur in the previously mentioned sensitive areas, there is little residual effect. Attention must be paid to underlying structures, as the barbs have the potential to cause penetrating injury as with any minor puncture wound. The only published work in the medical literature on human cutaneous effects of CEDs is by Anders et al, who described an autopsy of the histological changes of a 61-year-old male who was tortured with a stun gun during a robbery.[29]

Skeletal Effects

CEDs have not been shown to have any direct effect on the human skeletal system. However, injuries to the arms and shoulders, as well as facial trauma, have been reported as a result of subjects falling from a standing height during CED applications. There have also been reported cases of vertebral compression fractures in volunteer subjects undergoing a CED shock application. The proposed mechanism for these spinal fractures is related to the location of the barb contact points on the back of the subject across the relatively large paraspinous muscle groups. Forceful contraction of these large muscle groups of the torso can result in enough force to cause an acute compression fracture of the vertebral body. This is similar to the proposed mechanisms for compression fractures that have been reported after seizures.[30-32]

Brain and Central Nervous System Effects

There are no reported adverse effects by CEDs on the central nervous system. Subjects who have had CED activations remain awake and alert during the exposure and resume normal central nervous system function and control afterwards. In addition, subjects have full recall before, during, and after the event. There is a very noxious pain associated with CED activation, and some individuals have reported residual tingling at the site of attachment of the barbs following activation. There have been reports of CED probes penetrating the skull, but no reported direct damage to the brain either by the probe or the associated electrical discharge. There have been no published reports of seizures induced by the use of CEDs.

Psychological Effects

There are no studies on humans evaluating the effect of CED activations on the psychological or emotional state of an individual. There have not been any case reports published in medical literature reporting permanent psychological or emotional changes from CED use.

Cardiac Effects

In order to understand potential cardiac effects of CEDs, it is important to begin first with a little background. Electrical current applied to the heart can alter the electro-mechanical function of the heart muscle. As a result, devices such as defibrillators and pacemakers have been designed to direct electrical current to the heart for therapeutic purposes. Pacemakers direct an electrical impulse to the heart to help regulate the heart rate in an individual whose natural rhythm-generating ability is not working correctly. The problems with these individuals typically are that the heart rate is too slow because the natural electrical pulse of the heart is not functioning normally. The implanted pacemaker corrects this problem.

Defibrillators apply electrical energy to the heart to "reset" the cardiac electrical activity. In essence, these devices put the heart into an asystolic state (no electrical rhythm for the heart) temporarily to allow the native heart electrical pacemaker to resume normal functioning. There are two different types of defibrillators: internal and external. Internal defibrillators are implanted into a patient's chest wall with a surgical procedure during which electrodes are connected directly into the heart muscle. These devices are typically intended for individuals who have had, or are at risk for, life-threatening irregular heartbeats. The defibrillator is designed to detect the irregular heartbeat, prepare an electrical defibrillation shock, reconfirm the irregular heartbeat, and then deliver the shock if indicated to "reset" the heart's native electrical activity. External defibrillators have pads that are placed on the chest wall. They are used by paramedics and emergency physicians to shock an unconscious patient in a life-threatening heart rhythm. Since the energy from external defibrillators must travel through the chest wall, including muscles, bone, and fat to reach the heart muscle, the energy of external defibrillators is much greater than internal defibrillators.

Alternatively, electrical current applied to the heart can also cause abnormal electrical activity, including life-threatening dysrhythmias, such as ventricular fibrillation, or VF (a chaotic, disorganized heart rhythm), and sustained asystole (no heart rhythm). This is the case with electrocution or lightning strikes.

For externally applied currents in humans, induction of ventricular fibrillation is believed to be a function of the duration, frequency, and magnitude of the current, as well as the subject's own body weight. For an externally applied 60-Hertz (Hz) frequency electrical output, the threshold current for inducing VF in men has been proposed to be 500 milliamps (mA) for shocks of less than 200 microseconds' (ms) duration, and 50 mA for shocks of more than two seconds.[33] The longer a current flows, the greater the chance a shock will occur during the early electrical recovery of the ventricles of the heart after contraction (ventricular repolarization). This is known as the electrically vulnerable part of the heartbeat or cardiac cycle. Ventricular repolarization constitutes the initial component of the T-wave on the electrocardiogram and lasts for 10 to 20 percent of the cardiac cycle.[34] The Taser X26 reports a current of 2.1 mA lasting 400 microseconds.[35]

Resistance determines how much current flows for a given voltage (Voltage = Current x Resistance). The lower the resistance, the larger the current, and the more likely VF may be induced. The total resistance of the body is the sum of internal resistance plus twice the skin resistance, as current must enter and exit the body at two points (Forrest 1992). CEDs use very high-frequency electricity, and when combined with associated changes in skin resistance, these electrical currents tend to stay near the surface of the conductor. Hence, the output of the CEDs stays near the skin and muscle surface of the body rather than reaching internal organs, such as the heart.[36]

Published studies evaluating the effect of CEDs on cardiac physiology are limited, although in the last two years there have been several studies that begin to address this topic. Studies of the effects of Taser-type shocks on animals are discussed later in this chapter. Ethical issues arise when planning research on Tasers using human subjects. Research on real-world situations would require using subjects who are overweight, exhausted, and under the influence of alcohol and/or narcotics. Also, subjects would have to give consent to multiple exposures of the Taser under less than ideal situations. Informed consent becomes problematic when asking subjects to be exposed to such a variety of stimuli, and consequently, research on humans has been limited to fit subjects who are not exposed to alcohol or narcotics, or high levels of exhaustion. Most research on humans has been limited to police officers or those desiring to be police officers. While this limitation impacts the generalizability of the results, there is great merit in conducting such research. There have been cases where a Taser has been used on a variety of persons and the results have been studied. The following section will review the research and what we have learned from these applications of the Taser.

A study using 115 human volunteers was conducted by Levine et al, who electrocardiographically monitored the volunteers immediately before and after Taser shock during police training sessions. While the mean heart rate increased by 15 beats per minute following the Taser shock, investigators reported no change in cardiac rhythm or electrocardiographic intervals.[37]

A study by Sloane et al assessed for cardiac muscle cell damage after a single five-second shock. Utilizing a blood assay that checks for the presence of Troponin, an enzyme released within six hours after an injury to heart muscle cells, they found that in 66 healthy volunteers, none had an elevation of that enzyme. This suggests that there is no damage to cardiac muscle cells after a single shock.[38]

Respiratory Effects

The mechanics of breathing rely on the muscles of the diaphragm and chest wall to expand the chest cavity and the lungs on inspiration. There has been concern raised that a CED activation could affect these respiratory muscles, particular the diaphragm, and result in inadequate respiration. In theory, this type of hypoventilation could result in lower blood oxygen levels (hypoxia), higher blood carbon dioxide levels (hypercapnea) and increased blood acid levels (acidosis, from the increase in carbon dioxide). Concern has been raised that this respiratory acidosis could develop due to inhibition of respiratory function by repeated or prolonged CED activations. This effect could exacerbate any underlying metabolic acidosis from heavy exertion, drug use or agitation associated with excited delirium. This could also potentially precipitate cardiac irritability or abnormal heart function. Studies evaluating humans have demonstrated that people breathe during Taser activations.[39, 40] In one study, the investigators reported that measures of ventilation actually increased during a prolonged 15-second Taser discharge. This indicates that subjects were not only able to breathe, but actually increased their ventilatory and breathing efforts during the Taser activation.[41]

Other Physiologic Effects:

Pregnancy

The safety of CED use in pregnancy is unknown, but anecdotal reports suggest CED use should be restricted in this circumstance, if possible. A 32-year-old woman at approximately 8 to 10 weeks pregnancy received a 3- to 10-second CED activation, with one probe lodged in the abdomen above the uterus and the other in the left thigh. She fell to the ground and was reportedly unable to move for five minutes afterwards. One day later she began having vaginal spotting that continued for seven days, at which time she was diagnosed with an incomplete miscarriage. Pathologic analysis of the tissue from a uterine curettage revealed products of conception with extensive hemorrhage, necrosis, and inflammation. Though a temporal relationship was suggested between the CED activation and the miscarriage, no causation was established.[42] Another CED use on a six-month pregnant woman resulted in a civil settlement of a damages claim, after fetal demise was diagnosed approximately 12 hours following CED use. No causation was established for the CED. The situation was complicated by the fact that the woman fell following CED activation and by her history of methamphetamine use.

Children and the Elderly

There have been no human or animal studies to evaluate CED safety among the elderly or among children. There is a single case report of a seven-month-old infant who died after repeated shocks with a stun gun in an abuse case, and a letter to the editor regarding an adolescent who went into VF after a CED activation.[43, 44]

Subjects Under the Influence of Drugs and Alcohol

There have been no human studies of the effects of CEDs among persons under the influence of illicit drugs. There is a single study of the effect of a 15-second activation on human volunteers who were given mixed drinks in a controlled setting to achieve a blood alcohol level of 0.08 mg/dl. Compared with controls that did not have any alcohol, the alcohol group demonstrated a transient increase in lactate and small drop in pH that corrected within 24 hours. There were no changes in markers of cardiac injury and no evidence of elevated troponin levels in either group.[45] In an animal study utilizing a swine model, researchers noted that the infusion of cocaine into pigs resulted in a greater amount of energy (1.5 to 2 times as much) required to cause the heart to be shocked into VF when compared to pigs without cocaine.[46]

Review of the Literature: Case Series and Reports

The use of CEDs has been associated with cases of sudden in-custody deaths and has generated controversy in the lay press. Amnesty International (AI) reported in 2004 that more than 70 persons have died after CED activations by law enforcement. The AI report described many of those and other non-lethal scenarios in detail.[47] AI's conclusion was that while there is no clear causal link between CED use and adverse outcomes, there is a significant need for further research on this subject. The AI report also concluded that use of electro-shock devices is open to abuse, and recommended that law enforcement agencies strictly limit their use and provide full review and reporting with each deployment.

Kornblum and Reddy examined 16 deaths that were associated with Taser use from 1983 to 1987.[48] All involved young men with a history of abuse of controlled substances, and all but three of the 16 men were under the influence of cocaine, PCP, or amphetamine. Each was behaving in a bizarre or unusual fashion that necessitated a police response. In 15 of the 16 cases, the causes of death were determined to be drug overdose (11), gunshot (3), and undetermined (1). In the cases where the person was not under the influence of drugs, two expired of gunshot wounds, and the third died after being placed in a chokehold.

In the 16th case, these authors felt that the Taser may have contributed to the death. The subject had a history of cardiac disease; and it had been recommended he receive a permanent pacemaker, but he did not follow up. At autopsy it was determined he had both a diseased heart and lethal levels of PCP. The cause of death was listed as cardiac arrhythmia due to sick sinus syndrome, prolapse of the mitral valve, and electrical (Taser) stimulation while under the influence of PCP. The authors concluded that the Taser by itself did not cause death, but may have contributed to it. The authors suggested that the subjects in this study died after being in an agitated state known as "agitated delirium," with drug intoxication causing or predisposing the subjects to vulnerability to sudden death.[49]

These results were challenged by a pathologist from the Los Angeles coroner's office. The pathologist criticized the authors' conclusions suggesting that the Taser was at least partly responsible for 9 of the 16 deaths by stating, "Obviously if a person is shot with a Taser and then immediately killed with bullets, we are not in a position to draw a conclusion about whether the Tasering was fatal. A similar consideration applies when forceful restraint or chokeholds, which can also result in fatalities, are used. My point is that, with more than one type of injury, we are not free to exclude the Taser potentially contributing to death." [50]

In a prospective case review conducted from 1980 to 1985, investigators studied 218 patients who were taken to the emergency department (ED) after being subjected to a Taser activation.[51] These patients were compared with 22 similar patients who were shot by police with 0.38-caliber handguns during the same period. Subjects displaying bizarre and uncontrollable behavior represented 76 percent of all of cases in which the Taser was involved. Of the 218 patients, 95 percent were men and 86 percent had a history of recent PCP use.

The mortality rate in the Taser group in this study was 1.4% (3 patients). All three patients who died were in asystole upon arrival to the ED. Taser probes were embedded in the thighs, buttocks, and backs of these patients. All had high levels of PCP and went in to cardiac arrest shortly after being Tasered (from 5 to 25 minutes post-deployment). The Medical Examiner reports on these cases listed PCP toxicity as the cause of death, and there were no signs of myocardial damage, airway obstruction, or other fatal pathologic findings. When compared with the complications and injuries sustained from the 0.38-caliber handgun, the authors concluded that there was a marked and statistically lower rate of mortality and morbidity when the Taser was used.[52]

A recent review by Strote and Hutson of 28 autopsy reports available on 71 Taser-related deaths retrieved from LexisNexis and Google searches identified no deaths directly from Taser use, although six of the autopsy reports (21%) noted that the Taser may have been contributory. Excited delirium was thought to be either directly or indirectly related in 57 percent of the cases.[53]

Another review by Vilke et al involved the evaluation of 118 unique proximity deaths in subjects who had been subjected to a CED activation. These cases involved a total of 96 law enforcement jurisdictions in 26 states. Each agency was surveyed, with 60 (63 percent) agencies responding, resulting in data from 65 percent (77 of 118) of the CED proximity deaths. The majority of deaths were males (96 percent), white (46 percent), and individuals 31 to 40 years of age (38 percent). Among the 77 subjects, 20 (26 percent) were armed at some point during the incident, including four (20 percent) with a firearm, eight (40 percent) with a knife/cutting weapon, and five (25 percent) with a club/baton/blunt force weapon. Undesirable behaviors were also common, with 58 (75 percent) exhibiting noncompliance, 53 (69 percent) showing severe aggression, and 39 (51 percent) mild aggression.[54]

In a case reported by Haegeli et al, a 51-year-old 165-pound female with an implantable cardioverter-defibrillator (ICD) was exposed to an M26 model Taser with a five-second activation. The probes were located in the sternum, and she had no complications at the time of the activation. Two months later, she had her routine follow-up of her ICD with her cardiologist. At that time, they reviewed the recordings on the ICD around the time of the Taser activation. She had sinus tachycardia immediately before activation, running about 135 to 138 heartbeats a minute. During the Taser activation, signals were between 135 and 275 beats, causing the ICD to interpret her rhythm as an irregular heartbeat, ventricular fibrillation. Based on this misinterpretation, the ICD charged to deliver a defibrillatory shock, but did not deliver it to the subject because the Taser activation stopped by the time the device was fully charged. No true cardiac irregular rhythms were ever detected; only artifact from the Taser activation that mimicked VF and caused the ICD to prepare to defibrillate with a shock. The authors concluded that given the generalized tetanic contractions of most of the skeletal muscles during Taser energy delivery, there is likely no safe distance for a Taser hit in the presence of an ICD. No damage to the circuitry, including pacing functions, or reprogramming of the ICD occurred.[55]

In a letter to the editor, Kim and Franklin reported the case of an adolescent who was subdued with a Taser stun gun and subsequently collapsed. Paramedics found the adolescent to be in VF on their cardiac monitor and began performing cardiopulmonary resuscitation within two minutes after the collapse. After four shocks and the administration of epinephrine, atropine, and lidocaine, a perfusing cardiac rhythm was restored. The adolescent made a near-complete recovery and was discharged from the hospital several days later. The authors conclude that VF can occur after a discharge from a stun gun and suggested that law enforcement personnel carrying stun guns should consider also carrying automated external defibrillators. A great deal of detail is lacking from this case to determine if the Taser had a causative role in the VF. For example, there is no commentary on the mode in which the Taser was used during deployment, whether the child was taking any drugs, or whether the child had any previous cardiac conditions.[56]

Other reports include the case of a 27-year-old man who received a Taser activation. While in the back of the ambulance, he pulled out and swallowed the Taser barb, so that when the autopsy from the incident was performed "they would know it was the police" who killed him. The patient did not die and had no subsequent medical issues. [57] Given the projectile nature of CED darts, there have been several other case reports published describing eye injuries as well as bone penetration in a subject's finger.[58-60]

Review of the Literature: Animal Studies

This section is a review of each Taser-related study published utilizing an animal model. These studies used either dogs or pigs as the research model. Although these studies offer interesting insight on how the devices may affect the physiology of the species in question, it is important to understand the limitations associated with an animal model. No two species are the same, and what may be an effect in one species does not always translate to the other. In addition, these experiments are done using laboratory conditions, including anesthesia, and often with repeated shocks delivered to a single animal. Some of the studies do allow for a rest period between shocks, but the effects of the rest period are not known.

On the positive side, animal studies allow for the use of some conditions that would not be allowed in studies of human subjects for ethical reasons. Much of the work in research on cardiac arrest has been done in guinea pigs, rats, pigs, and dogs. A study cited below that involved infusing adrenalin into a pig to look at the effects of stress would not be allowed in humans. Additionally, we will never see studies in humans that seek to determine whether there are locations on the body which, if Tasered, will produce ventricular fibrillation. Therefore, there continues to be a place for animal studies, and as we learn more about the effects of CEDs, potential areas for research in humans can be elucidated.

Roy and Podgorski performed a study that used an older model stun gun that produced high voltages (more than 100,000 volts) and short duration pulses (less than 20 microseconds). They used five different models of stun guns with varying energies. The average value of the current applied during each shock was calculated to be 3.8 mA, which is higher than the current value for the Taser X26. When towels were placed between the skin and the electrodes to simulate clothing, the maximum current spike was 190 mA with a pulse length of 20 microseconds. Using two anesthetized normal healthy pigs, the investigators were able to induce VF when the leads of the stun gun were applied directly to the heart or to the chest of one of the animals in which a cardiac pacemaker was implanted. They surmise that the mechanism of action in that case was not to inhibit the pacemaker, but rather to give the stun gun's current direct access to the heart via the pacemaker leads, where it induced ventricular fibrillation. The shock also produced cardiac standstill when applied through the layers of simulated clothing for a prolonged period. However, these findings occurred with the 2 stun gun models delivering the highest energy. There were no cardiac effects seen with the lower-energy units. This study demonstrated that VF was indeed a possibility, but only at very high-energy outputs and when the electrical discharge occurred directly over, or had direct access to, the heart. Other studies have confirmed this.[61]

McDaniels and Stratbucker studied the Advanced TASER M26 in five anesthetized dogs with an average weight of 54 pounds. Electrical discharge of the devices placed directly over the chest failed to induce VF. In 236 discharges, there were no recorded episodes of VF. The authors noted that when both probes were placed directly over the heart, they were able to pace the heart in an action similar to that of a pacemaker, but again they did not induce VF. [62]

In a study by McDaniel et al, the cardiac safety of the devices was tested on nine pigs weighing 132lbs +/-62lbs. The animals were shocked using a device that was developed to deliver an electrical discharge identical in waveform and charge to that of the commercially available Taser X26 device. The voltage used for this study was less than the 50,000 volts used in the device, however. The animals were shocked for five seconds. The electrodes were placed across the thorax of the animals using the barbs that matched the probes used by the standard device. The study used gradually increasing amounts of charge delivered to identify two levels. The first was the lowest amount of charge required to induce VF at least once; this level was referred to as the VF threshold. The second level defined was the highest discharge that could be applied five times *without* inducing VF; this was referred to as the maximum safe level. The ratio of the VF threshold to the standard discharge level of the device was defined as the safety index.

The study found that the safety index ranged from 15 to 42 times the standard Taser energy output, as animal weight increased from 66 to 257 pounds, in a nearly linear fashion. In other words, the study found that the Taser discharge required in order to induce VF in the smallest pigs was 15 times the energy output of the standard Taser discharge, and the charge required to induce VF in the largest pigs was 42 times the Taser output. The authors concluded that discharge levels output by fielded Taser devices have an extremely low probability of inducing VF. The authors contend that their results suggest it is unlikely that VF or cardiac dysrhythmias are responsible for sudden deaths that have occurred after Tasering.[63]

An Air Force Research Laboratory animal study by Jauchem et al investigated the metabolic effects of repeated activations of a CED. Sedated pigs weighing 109 to 128 pounds received five-second discharges, alternating with five seconds of rest, for three continuous minutes. Animals demonstrated transient, clinically insignificant increases in potassium and sodium, a significant decrease in blood pH that returned toward normal one hour after exposure, a significant rise in blood lactate that returned to baseline at two hours, and a significant rise in whole blood pCO2 that returned to baseline at one hour (significant shifts with the parameters, particularly potassium and sodium, could indicate a change in cardiac stability (or instability) from a Taser activation). Animals then underwent one hour of monitoring followed by an additional three minutes of the five seconds of CED activation alternating with five seconds of rest. Additionally, the authors followed the levels of Troponin I, a cardiac-specific muscle enzyme that is a marker of damage to the heart. While the levels of this enzyme did not approach the predetermined cutoff of 0.35ng/ml, there were slight rises after the discharges, though not of statistical significance. The conclusions of the authors were that although a three-minute exposure, as outlined above, resulted in significant changes in blood chemistries, most levels returned to pre-exposure levels within in one hour after exposure. The applicability of this model to humans has yet to be determined.[64]

Wu et al performed a study to find the distance from the tip of a Taser dart to the heart that caused ventricular fibrillation (VF) in repeated attempts. Using 10 pigs weighing 118 to 164 pounds, the animals were anesthetized, intubated, and monitored. One dart, called the "heart dart," was placed over the right ventricle in decreasing distances (from 20cm downward) after skin and muscle were dissected away. This was the distance that the authors measured. The other dart was placed on the abdominal surface, anywhere from 15 to 54 cm away from the "heart dart." Five-second Taser discharges were used for the simulation. The discharge was delivered starting at 20 cm. If no VF was noted, then the distance was reduced by 2 cm and the discharge repeated. Once VF was induced, the researchers did further experiments to determine the energy for subsequent induction of VF. The dart-to-heart distance that caused VF on the first attempt was 17mm +/- 6.48 (SD) and for the average of subsequent attempts was 13.7 +/- 6.79 (SD).[65]

In an effort to extrapolate the implications of those findings on humans, the authors also measured skin-to-heart distance in healthy human volunteers using echocardiography and found that distance to be 10 to 57 cm in 150 subjects. They then performed a calculation that shows that the probability of the "heart dart" landing in the one square centimeter of skin surface that would make a person most susceptible to VF and that person having a skin-to-heart distance that would make them susceptible to VF. The study noted the probability of this occurring to be 0.000187. The conclusions of the study suggest that the conditions necessary for electrocution of the heart is a low probability event. They also recommend that all Taser training should be done with probes in the back, avoiding the torso.[66]

Lakkireddy et al tested nine different pacemakers and seven different internal cardiac defibrillators (ICD) in a swine model after a standard Taser shock.[67] The two darts of the TASER X26 were placed at the sternal notch and apex of the heart. Though the devices detected and interpreted the Taser discharges as cardiac electrical activity, and in some cases prepared to deliver a corrective shock, none was affected in a negative fashion by the discharges. In addition, none actually delivered a shock, as the termination of the five-second Taser discharge aborted any shock delivery by the device.

The study used a single small pig that weighed 62 pounds, and the dart at the apex was 15mm from the heart. The location of darts also bracketed the cardiac devices tested. Each device was tested using three standard discharges of five seconds each. No episodes of VF or Ventricular Tachycardia (VT) were initiated by the Taser shocks.

If an individual's internal cardiac defibrillator (ICD) was set for a time to shock delivery on detection of these impulses of less than 5 seconds, it is conceivable that a

Taser discharge could cause an ICD to deliver a corrective shock. It is also possible that in a pacemaker that is inhibited by the sensing of native electrical activity, the Taser discharge could inhibit the pacemaker from delivering its needed pacing activity.

The conclusions of the study are that a TASER X26 discharge does not affect the short-term functional integrity of the implantable pacemakers and ICDs tested. It was also determined that the standard duration discharge of five seconds should not result in delivery of an ICD shock in devices programmed to a non-committed shock mode.[68] If the ICD has a non-committed mode, it will reassess the rhythm one last time after the ICD is fully charged to assure that the patient is still in VF, and if so will deliver the charge.

As a follow-up to prior studies that suggest that pacemakers and ICDs do in fact detect Taser discharges and interpret them as native cardiac activity, Calton et al performed a simple, brief study to look at whether or not longer-duration Taser discharges (longer than five seconds) could result in an ICD delivering a corrective shock.[69] The researchers used two darts, one in the right parasternal region and one in the left lateral border of the thorax, and the distance between the darts was 30cm. They used a TASER M26 to deliver a five-second discharge, and then a 15-second discharge. During the five-second discharge, the devices detected the activity and charged but did not deliver their corrective shock because the discharge had terminated prior to the time to deliver the shock. However, in the 15-second discharge, the ICD did actually deliver two separate shocks.

The conclusions of the study were threefold: (1) In patients with newer devices, longer Taser discharges (15 seconds) could result in ICD discharge. (2) Because most devices are committed to deliver a shock after the first VF therapy, an inappropriate shock may be delivered even after the Taser discharge is no longer being given. (3) In older models of devices that only shock after sensing VF, even a short burst of energy could result in inappropriate ICD shocks.[70]

The authors aimed to evaluate the cardiac consequences of neuromuscular incapacitating devices on six anesthetized pigs weighing 45 to 55 kilograms. Both the TASER X26 and TASER M26 were tested. The researchers performed experiments with varied location of darts, including across the chest or across the abdomen, and varying duration of discharges of five seconds or 15 seconds. The first dart located across the chest was placed 5cm to the right of the sternum, and the second was placed on the left lateral border of the thorax with an inter-dart distance of 26 to 30cm. In a separate arm of the study, the animals were also given an infusion of epinephrine (adrenalin) to simulate physiologic stress.

When the discharges across the chest were recorded, 79 percent of the time the myocardium was directly stimulated based on the authors' criteria. The TASER X26 caused capture in 98 percent of discharges, versus the TASER M26 causing only 53.6 percent. Capture refers to the heart muscle being stimulated by the electrical activity and contracting based on that electricity. Going from five to 15 seconds with the TASER X26 caused a change from 96 percent capture to 100 percent capture. In the M26 the rate went from 47 percent to 60 percent. In the simulated-stress group, 13 of 16 discharges resulted in VF or VT.

These numbers appear awfully high when compared with other studies on pig models looking at myocardial capture. The model of darts across the heart does assume a "worst case scenario." The authors concluded that Taser discharges across the chest can produce cardiac stimulation at high heart rates.[71]

Nanthakumar et al aimed to study the effects of cocaine on the Taser-induced VF threshold in a pig model. This is the amount of energy required to induce ventricular fibrillation. Using five adult pigs weighing 75 +/-19 pounds, the researchers employed a custom device to deliver multiples of the standard discharge from the TASER X26 in a step-up and step-down fashion in order to determine the VF threshold. They used five different locations of dart placement (three on the ventral surface, and two on the dorsum). The results showed that in a single five-second discharge, VF was not induced in any dart position. The most sensitive position for VF induction was the sternal notch to the Point of Maximum Impulse (PMI) position. The infusion of cocaine increased the safety margin of the device from 1.5 to 2 times from baseline. Plasma levels of cocaine and benzoylecgonine 30 minutes after infusion were 557 +/- 280 U/l and 462 +/-123 U/l respectively.[72]

Review of the Literature: Human Physiologic Studies

Physiologic studies in human subjects offer direct insight into the effects of CEDs beyond that of animal studies. However, these studies are often challenging to perform for a variety of reasons, including the reluctance of human volunteers to participate, as well as a hesitance by research protections committees to approve such studies in light various perceptions regarding the safety of these devices. In addition, while a clinical laboratory setting allows the greatest control and measurement of important physiologic parameters, not all conditions that occur in the field setting, such as struggle, drug intoxication, and physiologic or psychological stress, can be reproduced with exact accuracy.

Despite these challenges, there is a growing body of recent literature and research on the physiologic effects of CEDs in human subjects. These studies have been both industry-sponsored (primarily by TASER International, Inc.) and non-industry sponsored. Most of this work has been conducted by two research teams: Dr. Jeffrey Ho's team from the Hennepin County, Minnesota, Medical Center, and a group at the University of California, San Diego (UCSD) which includes some authors of this report. In large measure, the findings from both these research groups are complementary. **The human physiologic studies to date have yet to find evidence of significant deleterious effects of CEDs on human subjects.**

Dr. Ho's group conducted a study sponsored by TASER International investigating the effect of a standard five second Taser X26 discharge on 66 human subject volunteers (65 men and 1 woman, age range 29 to 55 years) recruited at a TASER International training course.[73] Prior to the discharge, subjects had blood drawn for markers of heart muscle damage, skeletal muscle damage, electrolyte disturbances, and kidney function (troponin, myoglobin, lactate, potassium, glucose, blood urea nitrogen, creatinine, and creatine kinase levels). In addition, 32 of the subjects selected randomly had electrocardiographic evaluation prior to the Taser discharge.

The TASER X26 device was deployed at seven feet from the subject with the subject turned away from the weapon. During the five-second discharge, personnel supported the individuals, but would assist them to the ground if they fell. Blood tests were repeated immediately following the discharge and again at 16 and 24 hours. For the group undergoing electrocardiographic monitoring, repeat electrocardiography (ECG) was performed at these times as well.

The investigators reported no evidence of electrolyte disturbance or kidney dysfunction following the Taser discharge. In particular, there was no evidence of elevated potassium levels (hyperkalemia) that might have been associated with cellular injury. There was evidence of skeletal muscle activity with elevated myoglobin (at all three post-Taser test times) and lactate (initial post-Taser level elevated, but decreased at 16 and 24 hours). For the ECG subgroup, there were no changes between the pre-Taser and post-Taser ECGs. Two subjects had abnormal ECGs at baseline with no changes following the Taser.

All troponin levels for cardiac injury were normal (less than 0.3 ng/ml) with the exception of one subject who had a single elevated value (0.6 ng/mL) at the 24-hour post-Taser mark. This subject was evaluated in a hospital by a cardiologist and underwent further testing that demonstrated no evidence of acute myocardial infarction (heart attack) or cardiac injury in treadmill stress testing and heart imaging (rest/adenosine-augmented myocardial perfusion study). According to the authors, this individual was also never symptomatic and continued with his usual activities after hospital evaluation without difficulty. From their results, Ho et al concluded they were unable to detect any abnormal cardiac rhythms, direct cardiac cellular damage, or evidence of hyperkalemia that may be related to death proximal to CED exposure.[74]

Three non-industry-sponsored studies conducted by the University of California, San Diego group also investigated the cardiac effects of CEDs in human subjects and reported results concordant with the findings of Ho's group. Levine et al conducted a prospective, observational study of 115 law enforcement officers undergoing Taser training who volunteered to receive a standard TASER X26 discharge by either projectile probes or alligator-clip attachments.[75] Subjects were monitored by means of a three-lead electrocardiographic monitor at least five seconds before the discharge, during the discharge (average duration 3.0 seconds, range 0.9 to 5.0 seconds), and for at least five seconds after the discharge. After excluding 10 subjects because of monitor lead dislodgement during the Taser discharge, there were no significant abnormal cardiac rhythm disturbances or electrocardiographic anomalies detected comparing the pre-discharge with the post-discharge monitoring. The only notable finding was that subjects had an elevated heart rate prior to the Taser discharge (average 122 beats/minute, range 66 to 175 beats/minute) that significantly increased after the Taser discharge (average 137 beats/minute, range 75 to 190 beats/minute). This finding is of unclear clinical significance and likely is related to the pre-shock anxiety many subjects experienced, along with the painful stimulus that occurred with the Taser deployment.

In follow-up to this study, Vilke et al reported on 32 human law enforcement personnel volunteer subjects (27 men, 5 women) who had the more extensive 12-lead electrocardiogram performed immediately before and within one minute following a TASER X26 discharge (average duration 2.1 seconds).[76] The more extensive 12-lead electrocardiogram allowed investigators to measure actual times in the cardiac cycle including the PR interval (time from atrial to ventricular activation), QRS interval (ventricular activation time) and QT intervals (ventricular recovery time), for which any abnormalities could predispose subjects to abnormal cardiac rhythms. The authors reported a minimal increase in heart rate after the Taser discharge (increase of 2.4

beats/minute), and a slight decrease in PR interval, but otherwise no significant changes or abnormalities in QRS or QT intervals that would put an individual at increased risk for an abnormal cardiac rhythm. When stratified by gender or body mass index, the investigators reported no clinically relevant changes in their findings.

The third related study from the UCSD group was reported by Sloane et al. They described a prospective cohort study of 66 law enforcement volunteers who underwent a standard TASER X26 discharge (average duration 4.36 seconds, range 1.2 to 5 seconds) and subsequently had a blood serum troponin level drawn at six hours after the discharge.[77] A six-hour troponin level has been shown to be both sensitive and specific for the detection of myocardial infarction in the clinical setting. The investigators reported that none of the 66 subjects had an elevated troponin level (above 0.2 ng/ml), indicating that none had evidence of myocardial necrosis (or injury to the heart cells) as a result of the Taser discharge.

Recent work from Ho's group has focused on the impact of CEDs on respiratory function, particularly focusing on the effect of prolonged CED discharges.[78] Ho et al conducted a prospective observational study in 52 human volunteers who underwent either a continuous 15-second TASER X26 discharge (34 subjects) or three five-second repetitive exposures with one-second intervening intervals (18 subjects). Because of the continuous or repetitive exposure, subjects were placed in the supine position on a mat with manually placed Taser electrodes on the trunk or leg. Subjects underwent respiratory and ventilatory monitoring while data was collected, including oxygen and carbon dioxide (CO2) concentration measurements of expired air, respiratory rate, and tidal volume on a breath-by-breath analysis. Monitoring of these parameters occurred at baseline prior to Taser discharge, during the actual continuous or repetitive discharge, and after the Taser discharge until the subjects' measurements returned to baseline.

The investigators reported that measures of ventilation actually increased during the Taser discharge in both the continuous and repetitive discharge groups. This indicated that subjects were not only able to breathe, but increased their ventilatory and breathing efforts during the Taser activation. In the continuous discharge group, average minute ventilation in liters per minute (L/min) increased from a baseline of 16.3 L/min to 20.9 L/min; average respiratory rate increased from 15.9 breaths/min to 18.3 breaths/min; and average tidal volume (volume of air for each breath) increased from 1.1 L to 1.8 L. A similar, though smaller, trend was seen in the repetitive group with increases in minute ventilation (17.5 to 19.5 L/min), respiratory rate (14.6 to 18.7 breaths/min), and tidal volume (1.4 to 1.5 L) from baseline to during the Taser activation period.

In addition, the investigators reported that there was both an increase in oxygenation and decrease on CO2 concentrations in expired air, which is consistent with evidence of increased breathing and hyperventilation during the Taser activation. For the continuous discharge group, mean oxygen concentration increased from 118.7 mmHg to 121.3 mmHg, and mean CO2 concentrations fell from 40.5 mmHg to 37.3 mmHg from baseline to the Taser activation period. For the repetitive discharge group, mean oxygen concentrations increased from 123.1 mmHg to 127.1 mmHg, and mean CO2 concentrations fell from 40.9 mmHg to 39.1 mmHg. Based on their findings, the authors concluded that **they were unable to detect any respiratory impairment, and detected just the opposite, with increased ventilation during either a prolonged continuous or intermittent CED activation.** They found no evidence of decreased ventilation, increased CO_2 retention, decreased oxygen levels, or apnea (cessation of breathing) during the prolonged Taser activation.

The UCSD group recently conducted a comprehensive prospective trial funded by the U.S. Department of Justice investigating the effects of a standard five-second TASER X26 discharge on 32 healthy law enforcement personnel (27 men and 5 women) who were undergoing training on the device and volunteered to receive a Taser activation.[79] Subjects were monitored in terms of their cardiovascular, respiratory and metabolic physiology to determine the effect of the CED discharge. Cardiovascular measurements included 12-lead ECG at baseline and one hour post-activation, Troponin I levels at six hours post activation, and vital signs including heart rate and blood pressure measured at baseline and serially every five or 10 minutes following the discharge. Respiratory measurements included minute ventilation, tidal volume, respiratory rate, and end tidal pCO_2, measured at baseline and during the first five minutes after the Taser discharge, as well as subsequently at 10, 30, and 60 minutes. Pulse oximetry was measured for oxygen saturation at baseline and serially, similar to the vital signs measurements noted above. In addition, arterialized capillary blood was drawn for pH (acid/base status), pO_2 and pCO_2 concentrations at baseline and at 1, 10, 30, and 60 minutes after Taser discharge. Metabolic measurements included blood sampling for electrolyte levels (calcium, sodium, potassium, bicarbonate) and lactate levels at baseline and at 1, 10, 30 and 60 minutes after Taser discharge.

Vilke et al reported the results of this comprehensive study.[80] In terms of cardiovascular physiology, there was no evidence of ischemia or interval abnormalities noted on the 12-lead ECG before or after Taser discharge. All six-hour troponin levels, which are indicators of damage to the heart muscle, were normal in our subject population. There were no significant differences in heart rate or diastolic blood pressure before or after the Taser discharge. There was a statistically significant decrease in systolic blood pressure from baseline to 60 minutes following the Taser activation (mean 139 mmHg to 123 mmHg), but no evidence of hypotension or clinically significant abnormal vital signs.

The respiratory function, minute ventilation, tidal volume and respiratory rate all increased from baseline to the first minute following Taser activation, indicating an increase in ventilation during this time (mean increase of 12.8 L/min in minute ventilation, 0.5 L/breath in tidal volume, and 3.8 breaths/min in respiratory rate). In terms of oxygenation, there was no evidence of abnormally low oxygen levels (hypoxia) throughout the monitoring period by pulse oximetry measurement of oxygen saturation. There was also no evidence of hypoventilation or retention of CO2 in arterialized pCO2 concentration or etCO2 measurements.

In terms of metabolic physiology, there were significant changes in pH, bicarbonate and lactate levels initially following the Taser discharge, which returned to baseline levels within 30 to 60 minutes. Acid/base status, or pH, decreased significantly at one minute (mean change -0.02), but returned to normal at 10 minutes. There was no evidence, however, of an abnormal increase in blood acidosis, as mean pH levels were above 7.4 at all time periods. Bicarbonate levels, which often mirror pH and acid/base status, also were lower at 1 and 10 minutes (-1.2 and -1.8 mEg/L, respectively), but returned to baseline levels at 30 minutes. Lactate levels increased a small amount at 1 and 10 minutes (1.3 mmol/L and 1.0 mmol/L, respectively), but also returned to baseline levels at the 30-minute measurement. Otherwise, there were no significant abnormalities or differences in the other electrolyte measurements, including potassium levels. The investigators concluded that **in healthy individuals, a five-second TASER X26 discharge did not result in any clinically significant changes in cardiovascular function, respiratory or ventilatory parameters, or metabolic physiology other than transient changes in lactate and bicarbonate levels, with no evidence of acidosis.** Acidosis can affect cardiac electrical stability and risk for an irregular heart rhythm.

While the work of the Ho and UCSD group studies has shown that CEDs have little risk of detrimental physiologic impact on healthy subjects in controlled clinical investigations, the effects of CEDs in combination with other factors have yet to be determined. These factors include subject exertion, intoxication and stress, which are commonly encountered in the field setting. To that end, recent preliminary research has attempted to address these questions.

The Ho group recently presented data on the effect of CEDs in acidotic subjects following exertion.[81] In this industry-supported study, 44 human volunteers underwent an anaerobic exercise regimen, of whom 38 received a CED discharge and eight received a sham exposure. The investigators reported no differences between those who received the actual versus sham CED discharge in terms of pCO2 change, oxygenation change, lactate increase, or troponin levels. They concluded that markers of acidosis and cardiac injury were similar among acidotic subjects who underwent both real and sham CED exposures following exercise.

This same group of investigators also recently presented data on the effect of prolonged CED exposures (15 seconds from a TASER X26) on 25 human volunteers following a exercise regimen of timed push-ups and elevated treadmill sprints until subjective exhaustion simulated the physical exertion seen in subjects in the field.[82] Twelve-lead ECGs were obtained at baseline and following the Taser discharge. All post-Taser ECGs were interpreted as normal with no evidence of dysrhthmias or cardiac injury.

The UCSD group will be presenting preliminary data on a prospective, controlled trial comparing cardiac, respiratory, and metabolic physiologic parameters in subjects after exertion alone and following a CED discharge. Initial results indicate that systolic blood pressure decreased linearly from a slightly elevated baseline prior to Taser (140.9 mmHg at baseline) to normal (124.8 mmHg at 60 minutes) (decrease=16.1, 95% CI=8.3, 23.9, p=0.002). Heart rate decreased linearly post exercise through the observation period. Oxygen saturation never dropped below 96 percent for any specific measure interval. The pH and bicarbonate levels both decreased from baseline to post exercise (pH decrease =0.12, 95 percent CI 0.08, 0.16; bicarbonate decrease=4.1, 95 percent CI 2.7, 5.6) while lactate increased (increase=6.4, 95 percent CI 4.8, 8.0). The pH and lactate did not change from post exercise compared to one-minute and 10-minute post Taser (p >0.05). Bicarbonate measures were lower at one-minute and 10-minute post-Taser when compared to post exercise (decrease=3.8, 95 percent CI 2.1, 5.5 at one minute and decrease=2.9, 95 percent CI 0.6, 5.2 at 10 minutes) before starting to increase toward baseline measures at 30 minutes post-Taser. The pH returned to baseline levels by 30-min post Taser (p>0.05) and bicarbonate and lactate returned to baseline levels by 60-min post Taser (p>0.05). No changes were clinically significant.

The conclusions were that there were no clinically significant or lasting statistically significant changes in selected blood measures or cardiovascular levels in human subjects after rigorous exercise and a five-second Taser activation.[83]

Recently, the Ho group presented data examining the effect of CEDs on intoxicated subjects. In this study sponsored by TASER International, 26 human volunteers were given mixed drinks in a controlled setting to achieve a blood alcohol level of 0.08 mg/dl, after which 22 of the subjects received a 15-second CED discharge (four subjects served as controls). Compared with controls, the CED group demonstrated a transient increase in lactate and small drop in pH that corrected within 24 hours. There were no changes in markers of cardiac injury and no evidence of elevated troponin levels in either group.[84]

Suspect and Officer Injuries

There is always the potential for injury to suspects and officers during use-of-force incidents. The University of South Carolina released a study in 2007 that was designed to assess the impact of Taser deployment and other use-of-force technologies on the number of injuries to officers and suspects. The researchers collected use-of-force reports from the Richland County, South Carolina Sheriff's Department (RCSD) and the Miami-Dade County Police Department (MDPD). Although both departments used X26 Tasers, RCSD also had the option of using OC spray. The study found that injuries to suspects remained the same in Richland County after the introduction of Tasers. Data from MDPD indicated that the use of Tasers was associated with a reduction in injuries to both officers and suspects. This decrease included both major and minor injuries. Specifically, there was a 67-percent decline in the likelihood of an officer injury following the introduction of Tasers, and there was an 87-percent reduction in the likelihood of suspects being injured. The authors concluded that physical struggle poses the greatest risk for suspect and officer injuries, and that the likelihood of injury can be reduced through the use of OC spray and Tasers. [85]

There are several other police departments in Florida whose experience substantiates the findings of the University of South Carolina study. During the first six months of implementing the X26 Taser, the Sarasota Police Department witnessed a 65-percent drop in officer injuries. From 2000-2002, the Orange County Sheriff's Department experienced an 80-percent reduction in injuries to deputies, while the Putnam County Sheriff's office reduced deputy injuries by 86 percent in 2005 with the use of

Tasers. The Cape Coral Police Department saw a decrease in officer injuries by 93 percent during 2002-2004, while suspect injuries declined by 68 percent during the same period. From October 2003 to November 2005, there were 264 Taser deployments by the Hialeah Police Department. Of the 264 incidents, 263 suspects did not receive any serious injuries. [86] Most recently, Adams and Jennison (2007) published a review of what is known and not known about police use of the Taser and concluded that its potential for reducing injuries to officers and suspects is significant. [87]

Based on the available data, the Taser device appears to reduce injuries to officers and suspects. However, the pre-test/post-test designs of the studies, without comparison groups, limits the strength of the research. There is no way of knowing if some other factor in the environment might have led to the observed changes between the "before" and "after" periods. The Police Executive Research Forum is currently conducting a study for the National Institute of Justice examining the effects of Taser deployment on injuries to officers and suspects. The study is implementing a quasi-experimental design involving six law enforcement agencies that deploy Tasers and six agencies that do not. This study should produce more substantial findings regarding the impact that Taser deployment has on officer and suspect injuries. The study is scheduled for release in 2008.

Deaths and Risk Factors

As the frequency of Taser use increases, so do questions regarding the safety of the devices and concerns about possible misuses. As noted earlier, several groups have raised concerns that custodial deaths occurring in temporal proximity to the activation of a Taser may have been the direct result of its use. A study by the ACLU reported 148 Taser deaths in the United States and Canada between 1999 and 2005.[88] The work by the ACLU, Amnesty International, and others who have looked at deaths related to the Taser, have not been able to answer the question: would the suspect have died without the use of the Taser? In other words, there are suspects who die in custody because of health problems as well as being under the influence of drugs and/or alcohol. Those who have symptoms of "excited delirium" may be likely to suffer respiratory injuries and death, because of their drug use, and physical resistance to being arrested by the police, regardless of the use of the Taser (or OC. Spray).

Tasers are not the first less-lethal weapon used by police to provoke safety concerns. Prior to Tasers, there was concern over the use of pepper spray or oleoresin capsicum (OC) by police. OC is a naturally occurring inflammatory agent in cayenne peppers that causes swelling and burning of the eyes, nose, and throat. A 2003 a nationwide National Institute of Justice study investigated 63 in-custody deaths related to OC use. The study found that two of the deaths were due to exposure to the spray, but both people suffered from asthma. In the remaining 61 cases, factors other than OC use contributed to the fatalities. An earlier OC study conducted by the International Association of Chiefs of Police examined 22 custodial deaths between August 1990 and

December 1993. OC use was exonerated as a cause of death in all 22 cases.[89] A Police Executive Research Forum (PERF) study examining custodial deaths following Taser use found similar results as the OC spray studies; the deaths were a result of factors outside of the weapons' use.

PERF conducted a study examining custodial deaths between September 1999 and May 2005 that occurred in proximity to a Taser activation. A total of 118 deaths were identified and a comprehensive survey instrument was developed. An independent panel reviewed the survey to ensure clarity and consistency in content and terminology. PERF then invited 96 law enforcement agencies from 26 states to anonymously participate in the study. Information regarding 77 deaths and the circumstances surrounding them was obtained. Of the 77 cases, 75 percent were attributed to risk factors other than Tasers. This included 26 percent attributed to drug issues, 16 percent to a combination of excited delirium and drug-use issues, 10 percent to excited delirium, 8 percent to both health and drug-use issues and 4 percent to health issues alone. In 24 percent of the cases, the circumstances were unknown, the autopsy was not finished, or the death was attributed to other causes. The study found that the Taser was listed as the primary cause of death in one of the 118 custodial deaths.[90] As of this writing, TASER International, Inc. has not lost any wrongful death lawsuits.[91]

Popular Beliefs and Media Reports Regarding the Effects of Tasers

Methodology

An article search was conducted in LexisNexis that identified all instances of the words "Taser" or "stun gun" occurring in the headlines, lead paragraph, or key terms of major newspapers throughout the world during calendar year 2006 (n = 637). A total of 100 articles were randomly selected out of this population of 637 using a random number generator in Microsoft Excel. Any articles selected that did not pertain to Taser or stun gun use were dropped from the sample and replaced with the next article on the list. Articles were coded according to a number of categories, including: date, city, state, newspaper, the attitude of the article toward Taser or stun gun use (positive, negative, or neutral), the reasons for that particular classification, and the nature of the article. The classification scheme included codes for: the effectiveness of the Taser, whether serious injuries or deaths were involved, whether information regarding the safety/dangers of Tasers was provided, whether interviews were supportive or negative regarding Taser use, and any other miscellaneous indication that showed a positive or negative attitude. Based upon the overall attitude of the articles, each was classified as positive, negative, or neutral.

Attitudes Expressed Toward Tasers in Major Papers, 2006

The results from an analysis of the content of the articles show that approximately 80 percent referred to incidents when a Taser was used, and 20 percent discussed the Taser as a new technology for law enforcement, including information on its costs, potential benefits and effects. Almost 25 percent of the articles discussed situations when it would be appropriate for police officers to use a Taser, and 35 percent described how a death resulted from its use. Approximately 75 percent of the articles reported that citizens who were hit with a Taser were under the influence of drugs and/or alcohol. In more than 40 percent of the stories, a Taser was used against an armed suspect, the majority of whom had a handgun (30 percent of all the stories involved a subject with a handgun). More than 65 percent of the stories reported that the suspect on whom a Taser was used had assaulted an officer. Approximately 35 percent of the stories reported that the suspect on whom a Taser was used was emotionally disturbed or mentally challenged. The media reports concluded that a Taser was deployed more than once in 45 percent of the incidents. In about 15 percent of the incidents, the Taser missed its target or was not effective. It was noted that backup officers were at the scene in approximately 80 percent of the cases reported. In more than one-third of the incidents, other less-lethal weapons (baton, spray) were used before and/or after a Taser. Overall, the following attitudes were reported:

- 22 percent of all articles expressed negative attitudes
- 54 percent of all articles expressed neutral attitudes
- 24 percent expressed positive attitudes

- Twenty-four percent of the articles came from papers outside the United States.
    - Of those papers outside the U.S.:
        - Approximately 42 percent were from Canada (11 percent positive, 89 percent neutral)
        - Approximately 54 percent were from New Zealand or Australia (39 percent positive, 15 percent negative)

- 12.5 percent expressed negative attitudes toward the use of Tasers
- 62.5 percent expressed neutral attitudes
- 25 percent expressed positive attitudes

- Seventy-six percent of the articles came from U.S. newspapers. Of these:
  - 25 percent expressed negative attitudes
  - 51 percent expressed neutral attitudes
  - 24 percent expressed positive attitudes
- Florida papers had the largest number of articles (16 percent) relating to Taser use, followed by California (9 percent).
  - Articles in Florida and California papers were evenly distributed (19 percent positive, 19 percent negative, 62 percent neutral for Florida; and 33 percent in each category for California).
- 29 percent of the articles were "briefs" that were general descriptions of the Taser being used by officers and did not indicate any attitudes for or against Taser use.
- The most common reasons for negative attitudes included:
  - Citing reports of deaths by groups such as Amnesty International
  - Articles dealing with the death of an individual
  - Taser use was excessive or ineffectual at subduing a suspect
  - Negative attitude expressed by police or government official
- The most common reasons for positive attitudes include:
  - Positive view expressed by police or government official
  - Taser was effective and did not cause injuries, or injuries were minor

  - Some indication that Taser reduces the use of deadly force, either through report or interview
- Neutral attitudes were most often indicated in news briefs or were focused on the officer's decision-making and not Taser use, for example.
- Approximately 12 percent of the articles presented both positive and negative aspects of Taser use.
- The *St. Petersburg Times* printed the most articles regarding the use of Tasers (10 articles: two negative, six neutral, two positive).
- The cities that were cited most included Portland, OR; Tampa and St. Petersburg, FL.; and Houston and San Antonio, TX.

Myths about the Taser

Clearly, some misconceptions have been reported in the media concerning the Taser. First, and most serious, is the suggestion that Tasers cause ventricular fibrillation (VF) and death by electrocution. Second, the articles repeatedly reported that being hit with a Taser affects a pacemaker, and third, that they cause the subject to lose control of his or her bladder. Fourth, many articles reported that if a person receiving a Taser shock touches someone else, including the police officer, then that person will also receive a shock. Finally, many articles reported that probes from the Taser must penetrate the body to be effective.

Perceptions of Taser Use

Deaths occurring in proximity to the use of a Taser are far less common than is portrayed by the media. Of course, cases in which a subject dies after a Taser has been used receive a great deal more attention in the news media than the far more numerous cases in which there is no death or injury. Because the relatively few cases involving a death receive more attention, the public may get the impression that Tasers are more dangerous than they actually are. Most of the articles, however, express neutral attitudes toward Taser use, and make clear that when the Tasers were used, there were minimal, if any, injuries. Most of the articles were relatively short but were placed in sections and pages that would attract reader attention. From reading the sample of articles, citizens may develop the perception that Tasers are not being used appropriately (i.e., poor officer decision-making or use of Tasers on vulnerable populations). Interestingly, there were only a few articles that questioned whether a suspect would have died from a physical fight with multiple officers.

Conclusion

Conducted Energy Device (CED) technology has gained a more dominant role as an available less-lethal weapon for officers over the past several years. The most commercially successful CED in law enforcement is the line of products produced by TASER International, Inc. Individual police departments have credited the Taser with reductions in police shootings, use of force incidents, officer and suspect injuries, and excessive force complaints.[92, 93] Nonetheless, their adoption has not been without controversy.

Civil rights organizations have raised questions about whether CEDs are responsible for deaths that have occurred following their use. Research has found that it is more likely that the deaths were a result of other factors, such as excited delirium. In addition, medical studies revealed that many injuries are caused by falling down after being hit with the CED. The physiologic effects of Taser use have been found to be minimal and they generally subside once the electrical discharge is halted. Although some news media stories have suggested that Tasers cause Ventricular Fibrillation, medical studies have proved that this is not the case.

More studies need to be conducted on the medical consequences of Taser use, especially in regard to certain groups, such as children and the elderly. Additionally, there is a need for studies of the impact that CED deployment by a police agency has on use of force incidents, particularly injuries to officers and suspects. Based on the available research to date, CEDs appear to provide greater safety for officers, suspects, and the public.

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APPENDIX A

PERF CED Guidelines for Consideration & Glossary of Terms

These 52 CED guidelines for consideration are presented with the understanding that many use-of-force situations can change rapidly, and may require law enforcement officers to make quick decisions about force options. It is impossible to anticipate every possible use-of-force situation or circumstance that may occur, and in all cases officers need to rely on their training, judgment and instincts. However, the considerations noted below can help law enforcement officers make more informed judgments about CEDs and how and when to use CEDs to protect themselves and the public.

While every effort was made to consider the views of all contributors and the best thinking on the vast amount of information received, the resulting PERF guidelines do not necessarily reflect the individual views of every stakeholder involved in the development process, nor the views of the U.S. Department of Justice.

1. CEDs should only be used against persons who are actively resisting or exhibiting active aggression, or to prevent individuals from harming themselves or others. CEDs should not be used against a passive suspect.

2. No more than one officer should activate a CED against a person at a time.

3. When activating a CED, law enforcement officers should use it for one standard cycle and stop to evaluate the situation (a standard cycle is five seconds). If subsequent cycles are necessary, agency policy should restrict the number and duration of those cycles to the minimum activations necessary to place the subject in custody.

4. Training protocols should emphasize that multiple activations and continuous cycling of a CED appear to increase the risk of death or serious injury and should be avoided where practical.

5. Training should include recognizing the limitations of CED activation and being prepared to transition to other force options as needed.

6. That a subject is fleeing should not be the sole justification for police use of a CED. Severity of offense and other circumstances should be considered before officers' use of a CED on the fleeing subject.

7. CEDs should not generally be used against pregnant women, elderly persons, young children, and visibly frail persons unless exigent circumstances exist.

8. CEDs should not be used on handcuffed persons unless they are actively resisting or exhibiting active aggression, and/or to prevent individuals from harming themselves or others.

9. CEDs should not generally be used when a subject is in a location where a fall may cause substantial injury or death.

10. When a subject is armed with a CED and attacks or threatens to attack a police officer, the officer may defend him- or herself to avoid becoming incapacitated and risking the possibility that the subject could gain control of the officer's firearm. When possible, officers should attempt to move outside the device's range (approximately 21 feet) and seek cover, as well as request back-up officers to mitigate the danger.

11. When possible, emergency medical personnel should be notified when officers respond to calls for service in which it is anticipated that a CED may be activated against a person.

12. Officers should avoid firing darts at a subject's head, neck and genitalia.

13. All persons who have been exposed to a CED activation should receive a medical evaluation. Agencies shall consult with local medical personnel to develop appropriate police-medical protocols.

14. All persons who have been subjected to a CED activation should be monitored regularly while in police custody even if they received medical care.

15. CED darts should be treated as a biohazard. Officers should not generally remove CED darts from a subject that have penetrated the skin unless they have been trained to do so. Agencies should coordinate with medical personnel to develop training for such removal. Only medical personnel should remove darts that have penetrated a person's sensitive areas.

16. Following a CED activation, officers should use a restraint technique that does not impair respiration.

17. CEDs should not be used in the known presence of combustible vapors and liquids or other flammable substances including but not limited to alcohol-based Oleoresin Capsicum (O.C.) Spray carriers. Agencies utilizing both CEDs and O.C. Spray should use a water-based spray.

18. Agencies should create stand-alone policies and training curriculum for CEDs and all less-lethal weapons, and ensure that they are integrated with the department's overall use-of-force policy.

19. Agencies should partner with adjacent jurisdictions and enter into a Memorandum of Understanding to develop joint CED policies and protocols. This should include addressing non-alcoholic O.C. Spray carriers. Agencies should also establish multijurisdictional CED training, collaboration and policy.

20. If officers' privately owned CEDs are permitted to be used on duty, policy should dictate specifications, regulations, qualifications, etc. The devices should be registered with the department.
21. The CED "Probe Mode" should be the primary setting option, with "Drive Stun Mode" generally used as a secondary option.

22. CEDs should be regulated while officers are off duty under rules similar to service firearms (including storage, transportation, use, etc.).

23. CEDs should not be used against suspects in physical control of a vehicle in motion to include automobiles, trucks, motorcycles, ATVs, bicycles and scooters unless exigent circumstances exist.

24. The use of brightly colored CEDs (e.g., yellow) reduces the risk of escalating a force situation because they are plainly visible and thus decrease the possibility that a secondary unit mistakes the CED for a firearm (sympathetic fire). Note that specialized units (e.g., SWAT Units) may want dark-colored CEDs for tactical concealment purposes.

25. CEDs should be maintained in a holster on an officer's weak (support) side to avoid the accidental drawing and/or firing of an officer's sidearm.

26. Officers should be trained that the Taser CED's optimum range is 15 feet.[1]

27. Auxiliary/Reserve officers can be armed with CEDs provided they receive all mandated training and maintain all requalification requirements. Training and local statutes may dictate policy.

28. A warning should be given to a person prior to activating the CED unless to do so would place any other person at risk.

29. When applicable, an announcement should be made to other officers on the scene that a CED is going to be activated.

30. A supervisor should respond to all incident scenes where a CED was activated.

31. A supervisor should conduct an initial review of a CED activation.

32. Every instance of CED use, including an accidental discharge, should be accounted for in a use-of-force report.

33. Agencies should consider initiating force investigations outside the chain of command when any of the following factors are involved:

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[1] Association of Chief Police Officers, 2004. Independent Evaluation of the Operational Trial of TASER.™

a. A subject experiences death or serious injury;
b. A person experiences prolonged CED activation;
c. The CED appears to have been used in a punitive or abusive manner;
d. There appears to be a substantial deviation from training; and
e. A person in an at-risk category has been subjected to activation (e.g., young children; persons who are elderly/frail, pregnant women, and any other activation as determined by a supervisor).

34. When possible, supervisors and back-up officers should anticipate on-scene officers' use of CEDs by responding to calls for service that have a high propensity for arrest and/or use of a CED.

35. Every substantial investigation (and when possible every preliminary investigation) should include:

    a. Location and interview of witnesses (including other officers);
    b. Photographs of subject and officer injuries;
    c. Photographs of cartridges/darts;
    d. Collection of CED cartridges, darts/prongs, data downloads, car video, confetti ID tags; and
    e. Copies of the device data download.
    f. Other information as indicated in guideline #45.

36. Police leaders should be aware that CED download data may be unreliable. Police leaders and investigators should be able to articulate the difference between the actual duration of a CED activation on a person and the total time of discharge registered on a CED device.

37. CED activations should be tracked in the department's early intervention system (EIS).

38. The department should periodically conduct random audits of CED data downloads and reconcile use-of-force reports with recorded activations. Departments should take necessary action as appropriate when inconsistencies are detected.

39. Audits should be conducted to ensure that all officers who carry CEDs have attended initial and recertification training.

40. Departments should not solely rely on training curriculum provided by a CED manufacturer. Agencies should ensure that manufacturers' training does not contradict their use-of-force policies and values. Agencies should ensure that their CED curriculum is integrated into their overall use-of-force systems.

41. CED recertification should occur at least annually and consist of physical competency and device retention, changes in agency policy, technology changes, and reviews of local and national trends in CED use.

42. Exposure to CED activation in training should be voluntary; all officers agreeing to be subjected to a CED activation should be apprised of risks associated with exposure to a CED activation.

43. Supervisors and command staff should receive CED awareness training so they can make educated decisions about the administrative investigations they review.

44. Statistics should be maintained to identify CED trends and deployment concerns. Agencies may include display and arcing of weapons to measure prevention/deterrence effectiveness. CED statistics should be constantly analyzed and made publicly available.

45. The following statistical information should be included when collecting information about CED use:

   a. Date, time, location of incident;
   b. The use of the laser dot or display of the CED that deterred a subject and gained compliance;
   c. Identifying and descriptive information of the suspect (including membership in an at-risk population), all officers firing CEDs, all officer witnesses, and all other witnesses;
   d. The type and brand of CED used;
   e. The number of CED cycles, the duration of each cycle, the duration between cycles and the duration that the subject was actually activated;
   f. Level of aggression encountered;
   g. Any weapons possessed by the suspect;
   h. The type of crime/incident the subject was involved in;
   i. Determination of whether deadly force would have been justified;
   j. The type of clothing worn by the subject;
   k. The range at which the CED was used;
   l. The type of mode used (probe or drive stun);
   m. The point of impact of probes on a subject in probe mode;
   n. The point of impact on a subject in drive stun mode;
   o. Location of missed probe(s);
   p. Terrain and weather conditions during CED use;
   q. Lighting conditions;
   r. The type of cartridge used;
   s. Officer suspicion that subject was under the influence of drugs (specify if available);
   t. Medical care provided to the subject; and
   u. Any injuries incurred by an officer or subject.

46. Law enforcement agencies should conduct neighborhood programs that focus on CED awareness training. CED training should be part of any citizen's training academy program.

47. The agency's Public Information Officer should receive extensive training on CEDs in order to better inform the media and the public about the devices. Members of the media should be briefed on the department's policies and use of CEDs.

48. CED awareness should extend to law enforcement partners such as local medical personnel, citizen review boards, medical examiners, mental health professionals, judges and local prosecutors.

49. CEDs can be effective against aggressive animals. Policies should indicate whether use against animals is permitted.

50. Officers should be aware that there is a higher risk of sudden death in people under the influence of drugs and/or symptoms associated with excited delirium.

51. CED cartridges with longer barbs may be more effective in extremely cold climates.

52. Agencies should be aware that CED cartridges have experienced firing problems in extremely cold weather.

PERF CED Glossary of Terms

One of the first issues that led to confusion about CEDs was the disparity of terms used to describe the device. Various organizations used an array of terms to describe the same apparatus (e.g. electronic control weapons, electromuscular incapacitation devices, conducted energy weapon, etc.). Police agencies also used varied definitions for similar behaviors subjects exhibited (e.g., the term *passive aggression* may have different meanings for different police agencies). To minimize the confusion in discussing CEDs, PERF staff developed a list of terms and definitions used in relation to CEDs.

PERF staff examined numerous research reports and agency policies to create this glossary of terms. This list was then vetted through the DOJ's Less Lethal Technology Working Group prior to review at PERF's National Summit in Houston, Texas, to ensure consensus. The goal of the creation of these terms is to encourage consistency and strengthen clarity in regards to the accompanying national CED guidelines for consideration.

Accidental Discharge
The unintentional firing of a conducted energy device (CED).

Activate
Depressing the trigger of a CED causing a CED to arc or to fire probes.

Active Aggression

A threat or overt act of an assault (through physical or verbal means), coupled with the present ability to carry out the threat or assault, which reasonably indicates that an assault or injury to any person is imminent.

Actively Resisting
Physically evasive movements to defeat an officer's attempt at control, including bracing, tensing, pushing, or verbally signaling an intention to avoid or prevent being taken into or retained in custody.

Aggravated Active Aggression
Deadly force encounter.

Air Cartridge
A replaceable cartridge which uses compressed gases to fire two probes on connecting wires, sending a high voltage/low current signal into a subject.

Applicable Response
Response determined appropriate for the given operational scenario.

Arcing/Arching
Activating a CED without a cartridge.

Automatic External Defibrillator (AED)
An apparatus that monitors the heart of the patient and then automatically administers a controlled electric shock to the chest to restore normal heart rhythm.

Basis Response
Generic responses that describe how people routinely behave as the result of the application of a weapon or technology [or tactic, or procedure] employed against them.

Bodily Injury
Injury to the human body that requires treatment by a doctor or other health professional.

CED Cycle
Duration of a CED electrical discharge following a CED activation.

Central Information Display (CID)
Display of data on the back of a conducted energy device.

Circular Situational Force Model
A circular force training model that promotes continuous critical assessment and evaluation of a force incident in which the level of response is based upon the situation encountered and level of resistance offered by a subject. The situational assessment helps officers determine the appropriate force option, ranging from physical presence to deadly force.

Coincidental Injury
Injuries received in the incident not directly related to CED use (such as baton use, self-inflicted wounds, and gunshot wounds).

Conducted Energy Device (CED)
A weapon primarily designed to disrupt a subject's central nervous system by means of deploying electrical energy sufficient to cause uncontrolled muscle contractions and override an individual's voluntary motor responses.[2]

Confetti Tags
Confetti-like tags expelled from a cartridge of a CED when fired to shoot probes. Each tag contains a serial number unique to the specific cartridge used.

Continuum of Force/Response to Resistance
A training model/philosophy that supports the progressive and reasonable escalation and de-escalation of officer-applied force in proportional response to the actions and level of resistance offered by a subject. The level of response is based upon the situation encountered at the scene and the actions of the subject in response to the officer's commands. Such response may progress from the officer's physical presence at the scene to the application of deadly force.

Crowd Control
The use of police action to stop the activities of persons assembled.

Crowd Management
Observing, monitoring, and facilitating the activities of persons assembled.

Darts
Projectiles that are fired from a CED and penetrate the skin; wires are attached to the probes leading back to the CED.

Dart Placement
Point of entry for a probe on a person's body.

Dart (Barb) Removal
The act of removing a probe from a person's body or clothing.

Defensive Resistance
Physical actions that attempt to prevent officer's control including flight or attempt to flee, but do not involve attempts to harm the officer.

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[2] Conducted Energy Device (CED) is the preferred terminology for the weapon. It has also been referred to as Electro-Muscular Disruption Technology (EMDT); Electro Muscular Incapacitation device (EMI); Electro Muscular Device (EMD); and Electronic Control Device (ECD).

Deployment
Sending CED devices into the field with law enforcement officers.

Deadly Force
Any tactic or use of force that has an intended, natural, and probable consequence of serious physical injury or death.

Discharge
Barbs fired at a subject.

Drive Stun
To stun a subject with a CED by making direct contact with the body after a CED cartridge has been expended or removed for pain compliance.

Duration
The aggregate period of time that CED shocks are activated.

Electrocardiogram Monitor (ECG/EKG)
The machine that measures and records the electrical activity of the heart.

Electromuscular Disruption/Incapacitation (EMD)(EMI)
Effect CED has on the body. Overrides the brain's communication with the body and prevents the voluntary control over the muscles.

Environmental Factors
Factors such as wind speed, temperature, humidity, lighting, precipitation, terrain, etc.

Excessive Force
The application of an unreasonable amount (or force too long applied) of force in a given incident based on the totality of the circumstances.

Excited Delirium
State of extreme mental and physiological excitement, characterized by extreme agitation, hyperthermia, epiphoria, hostility, exceptional strength, and endurance without fatigue.

Exigent Circumstances
Circumstances that would cause a reasonable person to believe that prompt action is necessary to prevent physical harm to civilians and/or officers.

Firing
Discharging CED darts at a person.

Fleeing
An active attempt by a person to avoid apprehension by a law enforcement officer through evasive actions while attempting to leave the scene.

Group Cohesion
The ability to disrupt or control a group of individuals by either restricting or enhancing their organization, cooperation, and density.

Initial Basic Operator Training
The first basic CED training provided to officers prior to issuance of a CED.

Intentional Discharge Investigation
An investigation of the circumstances surrounding the firing or drive-stunning of a CED.

Intermediate Weapon
A weapon usage category situated between a *verbal command* and *lethal force* on a traditional force continuum.

Laser Pointing (Red Dot)
Unholstering and pointing a CED at a person and activating the device's laser dot.

Less Lethal
A concept of planning and force application that meets an operational or tactical objective, with less potential for causing death or serious injury than conventional more-lethal police tactics.

Less-Lethal Weapon
Any apprehension or restraint device that, when used as designed and intended, has less potential for causing death or serious injury than conventional police lethal weapons.

Measures of Effectiveness
Measures indicating the degree to which a target response satisfies a requirement within an operational context.

Measures of Response
Measures indicating how a target reacts to a system's effects.

Objective Reasonableness
Reasonableness of a particular use of force must be judged from the perspective of a reasonable officer on the scene in light of the facts and circumstances confronting the officer.

Onset Time
(ideally equal to zero) The period between the deployment of a less-lethal weapon system [or tactic, technique, or procedure] and the point when the magnitude of the desired effect attains some particular threshold.

Operational Effectiveness

That level of force necessary to achieve compliance, safeguard persons and property, or prevent injury.

Operational Safety
That degree of risk determined to be acceptable in order to accomplish a mission without unduly endangering officers, bystanders, or suspects.

Passive Resistance
Physical actions that do not prevent the officer's attempt to control, for example, a person who remains in a limp, prone position, passive demonstrators, etc.

Pointing/Aiming
Unholstering and pointing a CED at a person.

Post-Activation Investigation
An investigation of the circumstances surrounding the intentional or unintentional firing of probes or drive-stunning of a CED.

Primary Injury
(1^{st} Order Effect)
Immediate or delayed consequences of a CED resulting directly from an electrical current flow in the body.

Probe Spread
The amount of distance between probes fired from a CED (e.g., approximately one foot spread for every seven feet travel distance).

Proximity Death
The death of a person that occurred in proximity to the use of a conducted energy device (usually within 24 hours).

Psychological Intimidation
Non-verbal cues in attitude, appearance, demeanor, posture, or physical readiness that indicate an unwillingness to cooperate, pre-assaultive posturing, or a threat.

Physical Weapon Characteristics
The intrinsic qualities of a weapon including dimensional design values associated with a weapon (weight, caliber, size, power requirement, shelf life, etc.).

Secondary Injury
(2^{nd} Order Effect)
Physical trauma indirectly associated with CED use (e.g., injuries from falls).

Sensitive Areas
A person's head, neck, genital area, and a female's breast areas.

Serious Bodily Injury
Bodily injury that, either at the time of the actual injury or at a later time, involves a substantial risk of death, a substantial risk of serious permanent disfigurement, a substantial risk of protracted loss or impairment of the function of any part or organ of the body, or breaks, fractures, or burns of the second or third degree.

Spark Test
Non-contact testing of a CED by arcing it to ensure it is in proper working order.

Standard CED Cycle
A five second electrical discharge occurring when a CED trigger is pressed and released. The standard five-second cycle may be shortened by turning the CED off. (Note: If a CED trigger is pressed and held beyond five seconds, the CED will continue to deliver an electrical discharge until the trigger is released.)

Substantial Investigation
An extensive investigation into the use of a conducted energy device that is conducted by investigators outside the chain of command of the firing officer.

Target Recovery
(ideally full recovery immediately at the end of the desired duration) The period when the target response falls below a particular threshold and a full recovery of unimpaired functionality is desired in an operationally meaningful context.

Unintentional Discharge
The unintentional firing of a CED (includes discharges caused by involuntary muscle contraction and mechanical malfunction).

Ventricular Fibrillation (VF)
Ventricular fibrillation is a condition in which the heart's electrical activity becomes disordered.

Verbal Non-Compliance
Verbal responses indicating an unwillingness to comply with an officer's directions.

APPENDIX B

Use of Tasers in Controlling Humans: Training and Other Prerequisites

The Taser is a less-lethal weapon that can be used to control suspects who are not cooperating with police. As noted, a Taser introduces electrical current into the body of the subject and causes muscle cells to contract and has the effect of immobilizing the suspect by not allowing him or her to make voluntary movements. Although TASER International, Inc. has designed weapons for personal protection (C2, M18), the main usage of Tasers remains in law enforcement. TASER International sells its home self-defense weapons to civilians and suggests that they train themselves on the use of such devices by reading the instructions and watching an included DVD or CD-ROM. While this level of exposure to such a powerful weapon is probably insufficient for civilians to fully understand its uses and abuses, it is also unreasonable to give a law enforcement officer access to a Taser without significant training and education.

The goal of training officers to use the Taser is to impart knowledge that enables the skillful application of the weapon in real-world situations, without creating over-reliance on the weapon. In other words, the desired outcome of the training process is that the officer understands the use and application of a Taser, and he or she can apply that information properly during stressful situations in the field. Unfortunately, the length and content of training that is necessary to provide officers with sufficient information and experience to be competent with the Taser is not known. In a 2005 report by the U.S. Government Accountability Office (GAO), information on training in seven law enforcement agencies was reported. The agencies required training that lasted from four to eight hours, followed by a physical competency test. The GAO report was critical of the amount of Taser training provided by the agencies and noted the variation in the length of training among the agencies. Other criticisms included the lack of decision-making training, as opposed to the technical issues concerning the Taser. The report expressed concern that only three of the agencies required a written test that often included 10 "true or false" questions regarding their of use-of-force policy, the proper use of the Taser, and the use of safety measures.

As far the content of law enforcement training, the agencies emphasized the proper handling of the Taser, target acquisition, safety measures, function tests, overcoming malfunctions, and post-use deployment actions. Six of the seven agencies required yearly recertification in use of the Taser.

While the GAO report is limited in scope and content, it does provide a snapshot into Taser training issues in a limited number of departments.

As noted by the GAO, it is critical for the officer to understand that a Taser is not to be used in all situations that may require the use of deadly force, but rather is an option that has its strengths and weaknesses. It is an important aspect of training to make sure that officers realize where and when a Taser is best utilized and when it is not appropriate to use a Taser.

To learn the use of a Taser, an officer needs to remember facts about the weapon and the proper ways and procedures to deploy it. Officers must understand the concerns and limitations of the weapon, reinforce that knowledge through exercises, and demonstrate the knowledge by testing. Officers must also be familiar with the dangers associated with the Taser so that they do not injure themselves or others. Unfortunately, there may be some inadvertent injuries and situations in which cartridges misfire or Taser prongs do not hit where they were intended. The better the quality of training, and the more exposure an officer receives in it, the less likely he or she will experience a problem with the use of a Taser.

In order to achieve those training goals, many police agencies have simply adopted the manufacturer's guidelines and certified officers to use Tasers after they complete their training session. TASER International, Inc. has created training courses for users, instructors, advanced instructors, as well as training on medical issues for doctors and first responders, tactical training, executive training, correctional environment training, and personal defense courses. While the training created by TASER International provides important information, it is necessary for law enforcement agencies and states to create their own standards and certification requirements based on their own policies and working environments. Some agencies have full deployment of Tasers for all officers, while other departments are more selective in issuing the devices to selected groups of officers. Many agencies base their decisions on crime rates, prior experience, and budget.

Police agencies need to go beyond the training offered by TASER International, Inc. and develop training standards and curricula that are specific to their own local policies and needs. TASER International, Inc. has developed a series of training requirements for the use of the M26 and X26. The company is in its 13th iteration of training and suggests the following for certification as a user:

1. An annual certification.

2. A four-hour minimum of training, with optional additional training left to the agency.

3. A certified instructor must teach the course.

4. Although not required, it is recommended that the user be subjected to a "hit" from the Taser in order to experience its effects.

5. Each user should fire a minimum of two cartridges.

6. Each user must also pass a written exam with a pass rate of 80 percent.

7. Each user must undergo an oral examination with a pass/fail grade at the discretion of the instructor.

Clearly, training in the use of a Taser or any electronic weapon is a serious matter and must be similar to any training involving a weapon, including a firearm. The training suggested by TASER International, Inc. is a good start for an agency to review, but individual agencies must go beyond the manufacturer's guidelines and develop their own training and practical scenarios.

Develop Appropriate Department-Specific Training Materials

Training materials must provide clear directions to officers about when to use Tasers. In addition, Taser awareness information should be made available to the public, including the medical profession, first responders, mental health personnel, and community members. Professionals who interact with the officers or suspects need specialized training to perform their duties properly. Public awareness can take place in community meetings and in schools or through the news media.

Weapon Awareness

Officers need to be familiar with the mechanics of the Taser, its uses and impact on citizens as well as its limitations. While they do not need to become experts on the engineering of the device, they must know the basics on how the weapon works and the conditions that maximize and minimize its effectiveness. Specifically, officers will have to understand the impact of firing at a moving target or a subject who is trying to increase the distance between himself and the officer. Officers must know how to react if the weapon malfunctions or the wires land too close together. Additionally, officers must know how to insert and remove cartridges as well as download the data from the weapon.

Another related issue is where the Taser should be located on the officer's belt. Trainers will have to make sure officers place the Taser in a position where it will not be mistaken for a firearm. Departments are experimenting with different options, and the safest appears to be on the opposite side of the officer's body from the firearm.

When to Use a Taser – Implementation Considerations

As with any piece of equipment, officers need to know where the use of a Taser fits in the overall use-of-force policy for the department. Agencies with a traditional use-of-force continuum will have an easier time explaining the acceptable uses of a Taser than departments without a use-of-force continuum. Officers must know the issues associated with Taser use and vulnerable suspects. For example, special considerations must be given to subjects who are pregnant, young and/or small, or elderly and those who are operating vehicles and other machinery. Considerations must be based on the level of threat posed by the subject and the need to establish control over the subject.

Other issues, including the number of deployments, the total length of time for deployment, and use against suspects who are fleeing, must be part of a comprehensive training program. Practice in downloading use data, report writing, and other accountability matters must be part of a training package.

Videotapes of Taser Use

Officers should be shown several videotapes of Taser applications in real-life situations. In addition, tapes of training sessions demonstrating the effectiveness of the Taser compared to the effectiveness of other options, such as pepper spray, help the officers understand the uses and limitations of the Taser.

What to Do after Deployment

After the successful or unsuccessful deployment of a Taser, officers must know what to do. If the Taser works and the suspect complies with the officer's orders, officers must be trained as to when they can or cannot remove the darts, how to remove the darts, and what medical assistance is required. They also must know when it is necessary to photograph the areas where the darts entered the suspect's skin. If the Taser does not work as planned, officers need to know how to respond with an uncooperative suspect who may be a threat to the officer or others. Officers must be trained in the transition from an unsuccessful Taser deployment to other tactical attempts to control a suspect.

Experience and Practice

Officers should be required to deploy the Taser and to have experience with target acquisition. This sounds simple, but the deployment of the Taser barbs requires experience, because the top barb deploys straight, but the lower barb deploys on an eight-degree downward slope. This is designed to create distance between the barbs for maximum efficiency. However, it means that discharging a Taser is not the same as discharging a firearm. A Taser must be held and aimed with the understanding that both barbs must make contact. The X26 barbs require an approximate distance of 2 inches to effectively discharge the electricity. The greater the distance between the barbs, the more muscle groups will be disabled, making the deployment more effective. Unfortunately, this also means that the barbs may miss or contact the suspect's clothing, but not their skin. Officers need training to understand how to react if a barb misses or if it sticks in clothing, but does not contact the skin. If a barb sticks in a suspect's clothing, the officer must close the circuit with a drive-stun application, or maneuver the suspect to close the distance between his skin and the barb.

Mental Health Training

Mental health awareness should be a major component of Taser training requirements for all officers who are to be armed with a Taser. Identification of mental illness, excited delirium, and other conditions must be part of the training experience to show an officer what to expect from a suspect displaying certain symptoms. Most important is the understanding that the electrical shock may not have the desired effect that is hoped for or anticipated. Certain suspects may not be as susceptible to the electricity as other suspects. Officers must be trained to not rely solely on a Taser and to plan for alternatives should the Taser not work as expected. For example, officers must realize that after a specific number of attempts with a Taser, other options to control or apprehend the suspect are necessary.

Testing

In order to be certified as a user, officers should be required to pass an examination. The examination can be written, experiential, or both. The purpose of the test is to demonstrate knowledge about the Taser and the departmental standards. Officers should be retested and recertified annually.

Time Requirements

Although TASER International, Inc. suggests a minimum four-hour block of training, it is likely to take at least eight hours to complete a comprehensive training program with both classroom and field instruction.

Reporting

Officers must be trained on how to report the use of a Taser. They also need to know the reporting requirements and forms used by the agency.

Statistical Data on Agency Use

Agency-specific data should be used to show whether Taser use increases or decreases the number and extent of injuries to officers or suspects. Data should articulate if the use of the Taser impacts the use of firearms and other weapons. Documenting data also ensures department and officer accountability.

APPENDIX C

Legal Aspects: Magee v. City of Daphne

United States District Court,
S.D. Alabama,
Southern Division.
Troy MAGEE, Plaintiff,
v.
CITY OF DAPHNE, et al., Defendants.
Civil No. 05-0633-WS-M.

On October 31, 2005, Troy Magee brought a lawsuit against the City of Daphne, Alabama claming that his Constitutional rights were violated by "a vicious and cruel act of police brutality." The lawsuit stemmed from an incident two years earlier during which a Taser was used against him. On the night of November 3, 2003, two officers from the Daphne Police Department arrived at Magee's residence after another officer had established probable cause to arrest him for domestic violence. Magee came to the door without turning on any lights. When the officers asked him to step outside, he refused. After repeated attempts, the officers pulled out their Tasers and threatened to use them against Magee if he did not leave the doorway. When he again refused, one of the officers shot him with the Taser. After he bent over and asked why the officer had used the Taser on him, Magee was subjected to another use of the Taser in the chest area. Magee was able to remove the darts and quickly locked the front door. He then sprinted through the back door and hid in the woods behind his house until the officers left.

The court's analysis found that use of force by the officers was necessary. The officers perceived Magee as aggressive, angry, and under the influence of alcohol. Magee also refused to step outside, which made it impossible for the officers to approach him. Since the house was dark, the officers could not see whether Magee was holding a weapon or if there was another person inside. The officers warned Magee that they would use a Taser against him if he did not cooperate. When the first Taser was unable to temporarily incapacitate Magee, a second one was deployed to ensure that the incident did not escalate further. No serious physical injuries occurred as a result of the Taser use. Magee was able to run through his house and into the woods immediately after being shot. There was no indication that the officers used excessive force in this situation. As a result, the court ruled in favor of the officers, and Magee's lawsuit was dismissed.

APPENDIX D

MIAMI-DADE FIRE RESCUE
MEDICAL OPERATIONS MANUAL

ELECTRONIC CONTROL DEVICE
PROTOCOL 33

Law enforcement and/or civilian agencies may utilize an electronic control device (ECD) as a non-lethal method to incapacitate individuals. These ECDs directly stimulate motor nerve and muscle tissue causing temporary incapacitation. Typically it is not the ECD use itself that leads to the need for transport to the hospital, rather the events that have led up the individual being subdued with an ECD, such as excited delirium[1].

For those patients that have been subjected to an ECD, a complete history of the events and patient evaluation (Section B. 1 and 2) leading up to the application of the device is essential.

General

A. **History/Evaluation**

A patient exhibiting any of the following signs and/or symptoms will be treated by Miami-Dade Fire Rescue and transported to the most appropriate facility for further evaluation:

1. History of Events
    a. Evidence of excited delirium prior to the application of an ECD.
    b. Known or suspected cocaine, amphetamine, or hallucinogenic drug use.
    c. Cardiac history.

2. Evaluation
    a. Altered level of consciousness.
    b. Evidence of hyperthermia by either touch (hot to touch away from direct sunlight) or tympanic/temporal temperature > 102°F)
    c. Abnormal complaints including; shortness of breath, chest pain, nausea, or headache.
    d. Diaphoresis unexplained by the environment.
    e. ECD probes embedded in the globe of the eye or oropharynx.

f. Suspected c-spine or other significant musculo-skeletal injury.

B. Patient Care

BLS

1. Initial Assessment/Care.

   a. Prior to patient contact ensure that the ECD cartridge is not attached to the device.
   b. If the patient is still combative apply restraint in accordance MOM **(Procedure 27)**.
   c. The patient should be maintained in a face up or lateral recumbent (side) position to ensure a patent airway.

2. Administer oxygen (high flow) <u>regardless</u> of pulse oximetry reading (Procedure 1).

3. Determine probe location (if not already removed)

   a. For probes found embedded above the clavicles, in the groin, or in the area of the areola:

      1) Support and stabilize the probe in place as an impaled object.

   b. For probes found still embedded in other areas:

      1) Instruct the law enforcement officer to remove the probes. Fire Rescue personnel <u>will not</u> remove ECD probes.

4. Obtain blood glucose level **(Procedure 19)**.

ALS

5. For patients still combative or exhibiting signs of excited delirium:

   a. Provide sedation

      1. Versed, 5 mg IM or via the Mucosal Atomizing Device® (**Procedure 39**). This can be repeated once to a maximum dose of 10 mg, OR
      2. Versed 5 mg IVP every 5 minutes up to a maximum dose of 20 mg

   b. Obtain tympanic/temporal temperature. If temperature is > 102° F, mix 50 mEq (1 amp) of Sodium Bicarbonate with 1L of cool - cold (60° F) Normal Saline and infuse "wide open".

   c. This should be repeated once if there is continued hyperthermia OR signs of hypotension.

C. Conclusion

1. There is no evidence of serious injury or death directly related to the electrical application of the ECD. Overwhelmingly, persons exposed to the ECD develop complications as a result of predisposing problems such as excited delirium and drug overdose.

2. Fire Rescue personnel should take the time to carefully assess the events leading up to the ECD use as well as the patient history and presentation. If there is any doubt as to whether the patient should be evaluated by an emergency department physician, personnel should err on the side of care and transport the patient.

3. Clear and concise documentation describing all Fire Rescue assessment and actions must by documented in the narrative including the name of the law enforcement officer/agency in charge of the scene.

Footnote

1 Excited Delirium is a condition in which a person is in a psychotic state and extremely agitated. Mentally the subject is unable to focus and process any rational thought or focus his/her attention to any one thing. Physically the organs within the subject are functioning at such an excited rate that they begin to shut down. These two factors occurring at the same time cause a person to act erratically enough that they become a danger to themselves and to the public. This is typically where law enforcement comes into contact with the person. Possible causes of excited delirium may include, but are not limited to;

1. Overdose on stimulant or hallucinogenic drugs. NOTE: This is the cause in the majority of cases where an ECD is needed.
2. Drug withdrawal.
3. Psychiatric patient off medication.
4. Illness
5. Low blood sugar
6. Psychosis
7. Head trauma

Symptoms of excited delirium include:

1. Bizarre and aggressive behavior.
2. Dilated pupils.
3. High body temperature.
4. Incoherent speech.
5. Inconsistent breathing patterns.
6. Fear and panic.
7. Profuse sweating.
8. Shivering.
9. Nakedness.

High body temperature is a key finding in predicting a high risk of sudden death. Another key symptom to the onset of death while experiencing excited delirium is "instant tranquility". This is when the person has been very violent and vocal and suddenly becomes quiet and docile.

Police Executive Research Forum

A Study on the Effects of Tasers on Humans

Miami-Dade County, Florida
January 17, 2008

About the Police Executive Research Forum

- **Mission-** **Provide progress in policing: reducing crime, improving quality of life and treating citizens with dignity and respect**
- **Origins- Started in 1976; national membership organization; fosters debate, research and openness to challenge traditional police practices**
- **Research, executive development, executive search, consulting**

Examples of PERF's Prior Projects Involving Tasers

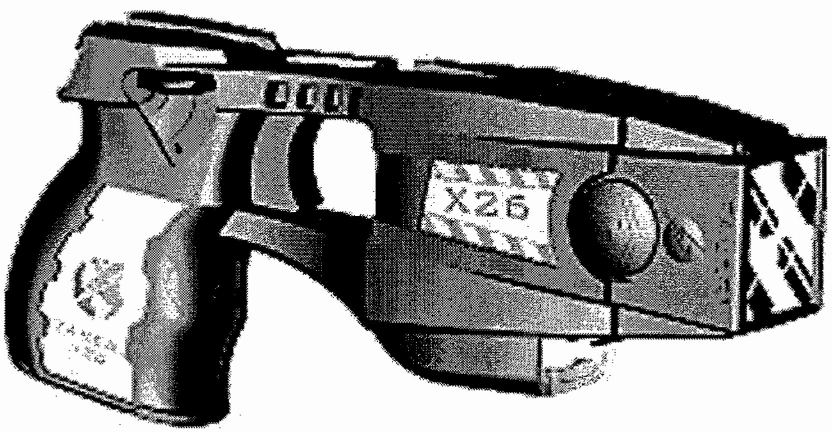
- State of the Field Survey
- Examined Deaths in Proximity to a Taser
- Taser Summit
- Member of the DOJ's Less-Lethal Working Group
- Conducted Energy Device (CED) Guidelines
- Glossary of Terms
- Examining injuries and cost

Miami-Dade Taser Project

- Summary and Description of Tasers
- Popular Beliefs and Media Reports
- Impact and Effects of the Use of Tasers on Humans
- Dr. Geoff Alpert, PhD
- Dr. Gary Vilke, MD

Taser Device

- 2000 Modern Taser (M26 and X26)
- Battery Operated (AA, Lithium)
- 2 Modes- probe and touch-stun



Electricity of the Taser

- 50,000 Volts [speed]
- 2 Milliamps (X26); 4 Milliamps (M26) [current/charge]
- 7-11 Watts (X26) 18-26 Watts (M26) [power]
- Electric Chair- 2,000 volts, 14 amps, 28,000 Watts

Topics for Discussion

1. Attitudes Expressed toward Tasers in the Media

2. Perceptions of Taser Use

3. Myths About Tasers

Attitudes Expressed toward Tasers in the Media

- 80 percent referred to incidents when a Taser was used
- 20 percent discussed the Taser as a new technology for law enforcement, including information on its costs, potential benefits and effects.

Attitudes Expressed toward Tasers in the Media

- Almost 25 percent of the articles discussed situations when it would be appropriate for police officers to use a Taser, and 35 percent described how a death resulted from its use.

Attitudes Expressed toward Tasers in the Media

- Approximately 75 percent of the articles reported that citizens who were hit with a Taser were under the influence of drugs and/or alcohol.
- In more than 40 percent of the stories, a Taser was used against an armed suspect, the majority of whom had a handgun.
- More than 65 percent of the stories reported that the suspect on whom a Taser was used had assaulted an officer.

Attitudes Expressed toward Tasers in the Media

- Approximately 35 percent of the stories reported that the suspect on whom a Taser was used was emotionally disturbed or mentally challenged.
- The media reports concluded that a Taser was deployed more than once in 45 percent of the incidents.
- In about 15 percent of the incidents, the Taser missed its target or was not effective.

Attitudes Expressed toward Tasers in the Media

- 24 percent expressed positive attitudes
- 54 percent of all articles expressed neutral attitudes
- 22 percent of all articles expressed negative attitudes

Attitudes Expressed toward Tasers in the Media

- The most common reasons for negative attitudes included:
  - Citing reports of deaths by groups such as Amnesty International
  - Articles dealing with the death of an individual
  - Taser use was excessive or ineffectual at subduing a suspect

Attitudes Expressed toward Tasers in the Media

- The most common reasons for positive attitudes include:
  - Positive view expressed by police or government official
  - Taser was effective and did not cause injuries, or injuries were minor
  - Some indication that Taser reduces the use of deadly force, either through report or interview

Myths about the Taser

- First, and most serious, is the suggestion that Tasers cause ventricular fibrillation (VF) and death by electrocution.
- Second, the articles repeatedly reported that being hit with a Taser affects a pacemaker.
- Third, that they cause the subject to lose control of his or her bladder.

Myths about the Taser

- Fourth, many articles reported that if a person receiving a Taser shock and touches someone else, that person will also receive a shock.

- Finally, many articles reported that probes from the Taser must penetrate the body to be effective.

Perceptions of Taser Use

- Deaths occurring in proximity to the use of a Taser are far less common than is portrayed by the media.
- Cases in which a subject dies after a Taser has been used receive a great deal more attention in the news media than cases in which there is no death or injury.

Perceptions of Taser Use

- Most of the articles express neutral attitudes toward Taser use, and make clear that when the Tasers were used, there were minimal, if any, injuries.

Perceptions of Taser Use

- There were only a few articles that questioned whether a suspect would have died from a physical fight with multiple officers.

Medical Effects of Tasers

- Muscular Effects
- Skin Effects
- Skeletal Effects
- Brain and Central Nervous System Effects
- Psychological Effects

Medical Effects of Tasers

- Cardiac Effects
- Respiratory Effects

Effects of Taser on Special groups

- Pregnancy
- Children
- Elderly
- Subjects Under the Influence of Drugs and Alcohol

The Medical Literature

- Case reports
- Animal studies
- Human Studies
  - 5 second and 15 second activations
  - With and without exercise
  - With Alcohol

Injuries and Deaths

- Injury Studies- studies indicate injuries to officers and suspects decreased or remained the same for police departments using Tasers

- Death Study
  - Examined the cause of 77 deaths
    - 1 case death was attributed to the device
    - TASER International has not lost a wrongful death lawsuit

Conclusion

- More studies are underway to examine injuries and cost associated with injuries

- Based on the available data, Tasers appear safe for officers and suspects