

Memo

To: Mayor Prussing and City Council

From: Chief Patrick Connolly

Date: 4/28/14

Re: Information on TASER Products

History of TASER

The TF76 conducted electrical weapon was invented in 1976 by Jack Cover. He was inspired to invent the TF76 by a science fiction novel, "Tom Swift and his Electric Rifle" written by Victor Appleton in 1911. The TF76 was a pain compliance tool only.

In 1991, Rick and Tom Smith purchased the legal rights from Jack Cover and started the company, Air TASER, Inc. which ultimately was renamed TASER International, Inc. They were motivated to start the company and develop a conducted electrical weapon (CEW) after one of their friend's was murdered during a road rage incident in Scottsdale, Arizona. They began working with Jack Cover to develop the first TASER International product. The name TASER is actually an acronym for Thomas A. Swift Electric Rifle, a tip of the hat to the book that inspired Jack Cover.

The first widely used TASER product was the TASER M26 in 1999. Before then and less well known, was the Air TASER 34000. Both of these models are no longer offered for sale to law enforcement. The next widely used product is the TASER X26, which was first sold in 2003. This model is carried by many law enforcement agencies to this day. TASER has indicated that it will discontinue sales of this model at the end of calendar year 2014. TASER International is now selling the X26P and the X2 models for law enforcement. Available for the civilian market are the TASER C2, TASER Strikelight, and TASER X26C, amongst others.

How a TASER works

At their core, TASER devices use electricity to interrupt the body's muscles. TASER devices use two steps in conducting what the company calls "shaped pulse technology". The first phase is called the "arc phase." This establishes conductivity between the X26 and the target. The second phase is called the "stimulation phase." The stimulation phase generates neuromuscular incapacitation (NMI) allowing the target to be controlled by sending an electrical current across the arc to the target. NMI is explained further below.

TASER devices are said to generate 50,000 volts. That piece of information is true, but only to a degree. TASER devices can generate 50,000 volts in the air. When conductivity is established with the target, due to the natural electrical resistance of the human body, voltage is actually 5,000 volts or less. The TASER X26 then uses 120 μC (micro coulomb) to generate neuromuscular incapacitation. 50,000 volts sounds like a lot of voltage to be used on a human, especially when voltage in modern day house construction is usually 110 volts.

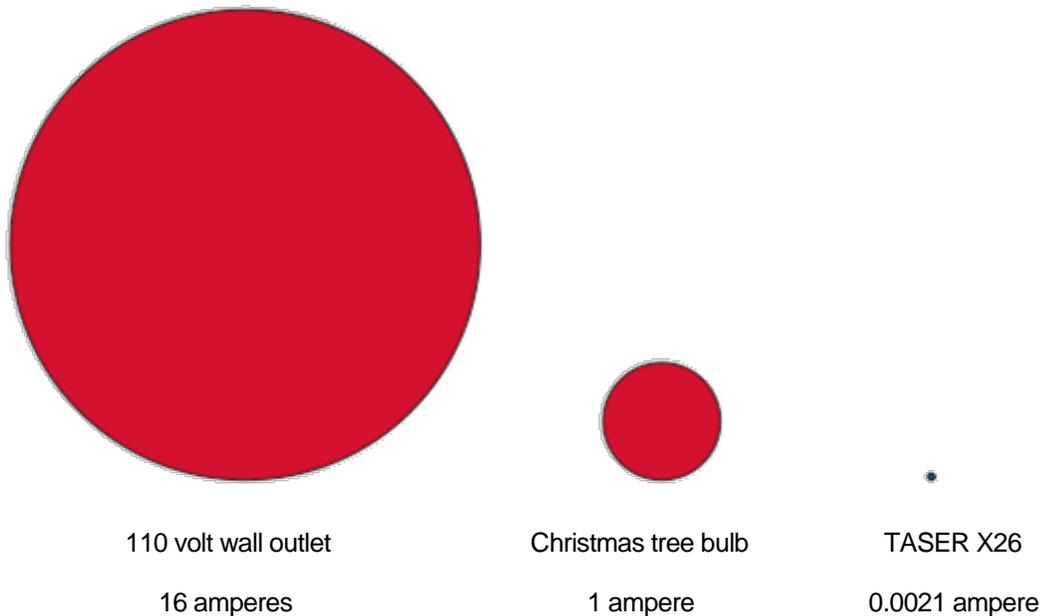
At some science museums, there are items called a Van de Graff generator. These can generate up to 2 million volts. Below is a photo of a child touching a Van de Graff Generator at the St. Louis Children's Museum. As you can see voltage alone is not a problem.



What should also be considered are the amperes and coulombs. The easiest way to think about these terms is related to the flow of water.

- Voltage translated to water pressure is typically measured in lbs. /in². With a TASER device, this is the “pressure” to push an electrical current through the wire.
- The current, measured in amperes, is the flow rate. Translated to water it is typically measured in gallons/second. With a TASER device this is the number of electrons flowing through the wire each second.
- Lastly, the charge is measured in coulombs. This is the quantity of water, typically measured by gallons/pulse. With a TASER device this is the number of electrons flowing through the wire each pulse.

Since amperes are also important in this equation, a typical wall outlet in a house is 110 volts with 16 amperes. For reference, a Christmas tree bulb draws 1 ampere. The TASER X26 generates 0.0021 amperes. Here is a visual reference for those numbers.



What is Neuromuscular Incapacitation?

Neuromuscular incapacitation is a disruption of the motor nervous system (carries commands from the brain to muscles) and the sensory nervous system (brings information into the brain). This means that there is an inability of the brain's electric signals to reach and control body muscles, with the overall effect of a subject being involuntarily immobilized and incapacitated. The initial sensation to the TASER's electric charge is pain, but this quickly turns into an awkward and possibly alarming condition of muscle spasms and involuntary movement.

The newest generation of TASER products also uses "shaped pulse technology" but with refinements. The major refinements relate to the physical part that generates the electrical charge. The X26 uses an analog gas tube. These are becoming increasingly scarce and difficult to purchase. The newest generation of TASER devices, the X26P and the X2, use all-digital architecture. These new devices use a silicon controlled rectifier (SCR). SCRs only conduct electrical energy in one direction. This allows for a more accurate output of Coulombs at the identified optimized level of 63 μC . The easiest analogy between the old analog gas tubes and the new technology of SCRs is much like a tube television and a plasma TV.

Safety of TASER Devices

TASER International, Inc. lists 595 articles, publications, and studies on its website. TASER International, Inc. financially sponsored some of those articles, publications, and studies. Some of them were not funded by TASER International, Inc. Undoubtedly, there are more available. As there are a number of references available, I went to what I thought were the most objective as my main references. Those references I used as primary were the U.S. Department of Justice, Office of Justice Programs, National Institute of Justice "*Police Use of Force, Tasers, and Other Less-Lethal Weapons*." and the U.S. Department of Justice, Office of Justice Programs, National Institute of Justice "*Study of Deaths Following Electro Muscular Disruption*."

Without regurgitating the contents of both articles, which is extensive, I will include some notable portions of the reports. For reference, the acronym CED means conducted electrical device.

"Police Use of Force, Tasers, and other Less-Lethal Weapons"

- "...The study's most significant finding is that, while results were not uniform across all agencies, the use of pepper spray and CEDs can significantly reduce injuries to suspects and the use of CEDs can decrease injuries to officers..." page ii
- "...A study by Wake Forest University researchers found that 99.7 percent of people who were shocked by CEDs suffered no injuries or minor injuries only. A small number suffered significant and potentially lethal injuries..." page 2
- "...The controversy around Taser use is not unique. Law enforcement agencies found themselves in similar circumstances with pepper spray in the 1990s. Amnesty International questioned the safety and misuse of pepper spray as its use spread rapidly in American law enforcement agencies. NIJ funded various studies on the safety and effectiveness of pepper spray..." page 2-3
- "...A few researchers have looked at how various approaches to force affect officer injury rates. Overall, the empirical evidence shows that getting close to suspects to use hands-on tactics increases the likelihood of officer injuries. Research also shows suspects have a higher likelihood of injury when officers use canines, bodily force or impact weapons such as batons. Alternatives to bodily force and impact weapons are found in other less-lethal weapons such as pepper spray and CEDs..." page 3
- "...Medical research, including controlled animal trials and controlled human trials, has produced various insights. Some animal studies were conducted to learn if CED use could result in ventricular fibrillation. Several studies showed that standard shocks that lasted five to 15 seconds did not induce ventricular fibrillation of the heart. Higher discharges, 15 to 20 times the standard, or those of longer duration – two 40 second exposures – induced fibrillation or increased heart rhythm in some pigs..." page 3-4

- "...Despite the limitations, the study's use of a large sample, representing more than 25,000 use-of-force incidents, allowed the researchers to use statistical techniques in an effort to learn which variables are likely to affect injury rates to officers and suspects. The use of physical force (hands, feet, fists) by officers increased the odds of injury to officers and suspects alike. However, pepper spray and CED use decreased the likelihood of suspect injury by 65 and 70 percent respectively. Officer injuries were unaffected by CED use, while the odds of officer injury increased about 21 percent with pepper spray use..." page 9
- "...The possible overuse of CEDs has several dimensions. CEDs can be used inappropriately at low levels of suspect resistance. Law enforcement executives can manage this problem with policies, training, monitoring and accountability systems that provide clear guidance (and consequences) to officers regarding when and under what circumstances CEDs should be used, or when they should not be used..." page 15

"Study of Deaths Following Electro Muscular Disruption"

- "...Studies by law enforcement agencies deploying CEDs have shown reduced injuries to both officers and suspects in use-of-force encounters and reduced use of deadly force. More recently, independent researchers have come to similar conclusions, when appropriate deployment and training policies are in place..." page vii
- "...There is no conclusive medical evidence in the current body of research literature that indicates a high risk of serious injury or death to humans from the direct or indirect cardiovascular or metabolic effects of short-term CED exposure in healthy, normal, nonstressed, nonintoxicated persons. Field experience with CED use indicates that short term exposure is safe in the vast majority of cases. The risk of death in a CED-related use-of-force incident is less than 0.25 percent, and it is reasonable to conclude that CEDs do not cause or contribute to death in the large majority of those cases..." page viii
- "...Law enforcement need not refrain from using CEDs to place uncooperative or combative subjects in custody, provided the devices are used in accordance with accepted national guidelines and appropriate use-of-force policy. The current literature as a whole suggests that deployment of a CED has a margin of safety as great as or greater than most alternatives..." page viii
- "...Unlike the risk of secondary injury due to falling or puncture, the risk of human death due directly or primarily to the electrical effects of CED application has not been conclusively demonstrated. However, there are anecdotal cases where no other significant risk factor for death is known. Additionally, current research does not support a substantially increased risk of cardiac arrhythmia in field situations, even if the CED darts strike the front of the chest..." page viii
- "...In general, the stress of receiving CED discharge(s) should be considered to be of a magnitude that is comparable to the stress of other components of subdual. All aspects of an altercation (including verbal altercation, physical struggle or physical restraint) constitute stress that may heighten the risk of sudden death in individuals who have pre-existing cardiac or other significant disease..." page ix
- "...It should be noted that arrestees who are involved in use-of-force incidents are by nature at higher risk for serious complication and death relative to overall population. These individuals are more likely to be drug-intoxicated, be mentally ill or have serious underlying medical conditions. There are more than 600 arrest-related deaths in the United States each year and roughly 1 million incidents in which police use or threaten to use force. Nonetheless, the CED is cited as a causative or contributory factor in very few arrest-related deaths each year. In this context, the relative risk of CED deployments appears to be lower than other use-of force options..." page 3

Additional Research Concerning the Question of TASER Safety

A document presented to the Mayor and Council on March 24, 2014 by Carol Ammons identified various concerns about the safety of TASERs. In an effort to address those concerns, I contacted Darrell Ross, Ph.D., Professor and Department Chair for the Department of Sociology, Anthropology and Criminal Justice at Valdosta State University. Dr. Ross reviewed that document and prepared a five page response in an effort to provide a better understanding. I have attached a copy of Dr. Ross' response as well as his biography.

Additional Safety Features

As a result of the all-digital architecture, the new devices (X26P and X2) now use what is called "charge metering." Charge metering is the measurement of the electrical output from a TASER device. TASER devices utilize charge metering 19 times a second to modify the charge to the optimized level of 63 μC . What that means in its simplest form is that the device measures the charge that the target receives and if the charge is too high, it lowers the next charge. Conversely, if the charge is too low, the charge is raised to the 63 μC level. Both the X26P and the X2 not only use charge metering, they record that information in the device so that it can be retrieved later during a download of the device.

There are some claims that the TASER devices can stop the human heart. This is not true. When first responders find someone having a cardiac event, they use an automatic external defibrillator (AED) to establish a normal cardiac rhythm. These devices are in nearly all public buildings in the United States.

The automatic external defibrillator (AED) delivers 360 joules to a target. The American Heart Association Pediatric Advanced Life Support Guidelines recommend 2-10 joules per kilogram (2.2 lbs.) for infants and children. The TASER X26 delivers only up to about 0.1 joule. A joule is an international system of units measurement of energy (mechanical, electrical, or thermal) describing the energy delivered in a single pulse.

Training Recommendations

TASER International, Inc. recommends a minimum of six hours of training for an end user of their products. Lieutenant Richard Surlles, the department's TASER instructor, recommends that the Urbana Police Department provide training to the end user in a 12 hour block of instruction.

Policy Recommendations

If approved, the Leadership Team, in conjunction with the Civilian Police Review Board, will review a variety of sample policies and will create a department policy based on the best practices. More information will become available once the pilot program is approved.

At a minimum, Lieutenant Surlles recommends that the policy includes the following:

- Only officers that have completed department approved training may carry a TASER.
- Officers shall wear the TASER in an approved holster opposite their duty handgun to avoid confusion.
- Officers carrying a TASER will be required to complete annual training and qualification.
- The carrying of a TASER will be strictly voluntary by the officer, but if the officer chooses to carry a TASER, they will be required to be exposed to the TASER in probe mode. This allows the officer to have firsthand knowledge about the pros and cons of using a TASER.
- The department may revoke the ability of an officer to carry a TASER.
- When practicable and it does not endanger the officer, a warning should be given to the subject prior to deployment. This allows the subject to voluntarily comply without actual application.

- No deployment is permitted against a subject that is passively resisting without posing an articulable threat of harm to officers or others. This includes drive stuns.
- Intentional deployment of probes or application of drive stuns are not permitted in sensitive areas (head area, neck area, breasts, and groin area).
- The preferred target zone is lower center mass/legs for front shots to prevent head/eye shots in a dynamic situation. The preferred target zone is the major muscles of the back and legs for back shots.
- Officers shall monitor the subject for injury as soon as practicable after the person is under control.
- Should a probe land in a sensitive location, officers shall not remove the probe and shall cause the subject to be transported to a local emergency room or medical provider for removal. Otherwise, officers will remove the probes based on training. They will treat the probes as a biohazard.
- The policy will specifically identify high risk deployment situations and training will emphasize these situations:
 - A subject in an elevated position
 - A subject operating a vehicle or machinery
 - A subject in a flammable or explosive environment
 - Pregnant females
 - Elderly or infirm persons
 - A subject in or near water (drowning risk)
- A subject who has been exposed to an electrical discharge from a TASER that falls under any of the following categories, will automatically be examined or transported to a paramedic or other qualified medical personnel:
 - A person who may be pregnant
 - A person who appears to be in need of medical attention
 - TASER probes are lodged in sensitive areas
 - A person who requests medical treatment
 - A person who is suspected of being under the influence of controlled substances or alcohol
- After the deployment of a TASER either in probe or drive stun mode, the TASER will be downloaded. That downloaded information will accompany the report. Only a certified TASER instructor, armorer or command personnel will have access to the original downloaded files.
- Equip all TASERs issued to officers with a TASER camera that begins recording when the safety is disengaged.
- A supervisor will, as soon as practicable, complete an administrative investigation into the use of force. The supervisor will submit a report detailing the investigation. Both the officer's report and the supervisor's report will be reviewed by the Use of Force Committee. Improper uses of force, like always, subject the officer to corrective action to range from additional training to termination.

- The department will establish a review process with CPRB to review each deployment.

Funding

It is recognized that the City of Urbana is facing funding issues. The cost for training and equipment would be requested through the upcoming Justice Assistance Grant (JAG) funds. The TASER devices with cameras and related training equipment would be approximately \$26,000 if warranties were also purchased. Without warranties, the cost would be approximately \$22,000.

Conclusion

TASER devices have been widely used by civilians and law enforcement since 1999. Since that time there have been in excess of 2.5 million deployments against human targets. This number includes field, training, and research deployments. The effects of a TASER have also been widely researched. Research on actual field deployments indicated that they cause either no or minor injuries (such as scrapes and bruises) in 99.75% of cases. Unfortunately, there is some risk of injury during any physical altercation. Our goal is to take people into custody without any harm.

Recognizing the community concerns of this tool, the Urbana police present this request with this three-pronged philosophy:

- With good policy, training, and oversight, TASER devices are safe.
- TASER devices can help avoid deadly force encounters.
- TASER devices will reduce injuries to both subjects and officers.

To: Chief Patrick Connolly
From: Dr. Darrell L. Ross
Date: April 7, 2014
Subject: Conducted Energy Weapons Issues

1. *Amnesty International has documented over 460 deaths caused by Tasers (CEWs) between 2001 and 2010.*

The AI report is severely flawed. Applying its own numbers and assertions, just 2 percent of sudden in custody deaths proximal to CEW application have been deemed by medical authorities to be “potentially associated” to the CEW. Temporal association to the usage of a CEW does not equate to “causation.” What the writer of the letter fails to mention in most cases coroners and medical examiners have listed the cause of death as “unrelated” to the use of the CEW. Just because a death occurred (temporal) after the use of a CEW does not equate to causation.

AI acknowledges that they use Bureau of Justice Statistics (BJS) regarding arrest-related deaths which occur annually in the US. Annually about 300 suspects die in police custody and the BJS has not shown any linkage to these deaths by an application of the CEW. The research indicates that where an arrest-related death in custody may occur is more likely related to the restraint process and to the mental, physiological, and poly-substance abuse history of the subject and not from an application of the CEW. There is a difference between an arrest-related death and a sudden in custody death. It should be noted (and is omitted from the author’s email) that sudden deaths in custody predate the use of CEWs and can be traced back to 1841 when Luther Bell observed the condition in psychiatric patients. It appears that the writer is inappropriately relying on a bogus report statistics submitted by the AI in an attempt to thwart a legitimate and valid review of the use and application of CEWs.

The writer also claims that CEWs are used in excess against African-Americans. Again, there is no basis for this statement. Since 1970 every scientific review of the police use of force has consistently shown that police use force in less than 1 percent of contacts with the public and that officers were justified in using more force than what they decided to use. Research also has consistently shown that where use of force is more likely to be used is in “hot spot” areas of calls for service which account for more violence and Part 1 Index crimes including calls revolving around domestic violence, the drug culture, gangs and gang violence, and disturbance calls. Research has repeatedly shown that violent crime trends are significantly intra-racial and African American males are eight times more likely to commit homicides and seven times more likely to be murdered than whites, and males ages 13 to 30 are more likely to be victims of violent crime.

Younger males are at more risk of engaging in criminal behavior and being a victim of crime and such disproportionately brings them into contact with the police. Their risk taking criminal behaviors and lifestyle, which occurs in these hot spot locations, coupled with gang behavior and the drug culture multiplies the likelihood of a police contact. The research on calls for service in identified hot spot areas increase the likelihood that the use of force will be more likely used by police, not inevitable, but more likely given the circumstances. The research continually shows that calls for service, their location, and crime trends analysis underscore a disparity in the police

use of force under these circumstances and not one of “discrimination.” Over the last 30 plus years, the research on the police use any force consistently shows that force is not racially motivated but associated with the nature of the call, circumstances, resistive behaviors of the subject, and location of the call.

2. *Comparisons of a Conducted Energy Weapon (CEW) to other electrical devices.*

There is a great deal of unwarranted concern of electrocution based on lay misunderstanding of the reported 50,000 volts (V) peak open arcing voltage of CEWs. CEWs deliver only a fraction of the 50,000 V to the body. In the case of the TASER X26 CEW, the mean delivered pulse voltage is 580 V. However, it is not the voltage, but the delivered electrical charge, that actually creates any risk for cardiac effects (which is medically insignificant). For example, the static electricity from walking across a carpet can generate 30,000 to 100,000 V. However, the average, aggregate, and actual delivered electrical current of the TASER X26 CEW is only about 1.9 milliamperes (mA) (or, 0.0019 amperes (A) and the peak current is only about 3 A. By way of comparison, a TASER X26 CEW has a peak current of about 17 A; an International Electrotechnical Commission (IEC) Level IV static electricity shock has a peak current of 30 A; a Christmas tree light string will have on average current of 0.4 A or 400 mA, which is about 200 times the average (or actual or aggregate) delivered current of the TASER X26 CEW.

The stored energy in the TASER X26 CEW is about 0.36 joules (J) per pulse (J/pulse), and the delivered energy is about 0.1 J/pulse, with the comparison of an automatic external cardiac defibrillator (AED) used many times per day by paramedics using 360 J, over 3000 times greater than the X26 CEW. This limited amount of delivered electrical energy is very low and is transferred to a person makes sense as the TASER X26 CEW is only powered by a battery of two 3 V cells (Duracell® CR123s), commonly used in some small digital cameras (such as the Nikon F6), not an electrical outlet or power generator. It is the CEWs rapid cycling that can cause the subjects' muscles to contract at about 19 times a second that can offer the effective incapacitation of the subject in the probe mode, or painful compliance in drive-stun mode, while still offering a significant safety margin from electrical injury. Once the energy from a CEW is turned off, the subject is back to his physical baseline.

The TASER X26 CEW generates significantly less effective voltage, current, charge and energy than medical devices, such as external defibrillators and ablation radio-frequency (RF) generators, which are approved and deemed safe for medical use. CEWs do not deliver 50,000 V because the initial 50,000 V spike, necessary to ionize the air gap, drops to approximately 1,750 V or less, as soon as the probes or electrodes make contact with the body. By comparing their electrical output with that of several medical devices, it can be stated, with high scientific confidence, that CEWs are not life threatening and have an electrical output far lower than RF generators, defibrillators, pacemakers and internal cardiac defibrillators (ICDs). There is not even the remotest comparison of a CEW to an “electric chair.”

The IEC 60479 standard deals with effects of electrical current on human beings and livestock. IEC 60479-1 describes the effects of sinusoidal alternating currents with frequencies between 15 hertz (Hz) and 100 Hz and of direct currents passing through the human body, respectively. The effects of non-sinusoidal currents of higher frequencies are covered by IEC 60479-2. Section 11.4 describes the thresholds of VF for impulses of short duration. It states that “for 50% probability of fibrillation, F_q is of the order of 0.005 As.” F_q is defined as the charge of the impulse. By the definition of current, charge and time units of measurement, the quantity 0.005 As is equal to 5000 μ C. The first peak of the TASER X26 CEW current (and by far the largest) carries a charge

of about 100 μC . This is at least 50 times less than the threshold indicated by IEC 60479-2 for a 50% probability of VF induction. Consequently, the electrical output of a typical TASER X26 CEW is well within the 'no fibrillation' region, as defined by IEC 60479-2, even for an application with hypothetical durations of longer than 50 seconds.

A documented TASER X26 CEW trigger pull is not synonymous with electrical charge delivered to the person. In order for a CEW to deliver a charge to the person the electrical circuit must be completed and maintained. Thus, if a probe is dislodged, clothing, like a shirt or coat moves the probe away from the subject, the total gap between the electrodes and the subject exceeds five centimeters (cm), a wire is broken, or other factors, each can result in an X26 CEW download documenting a trigger pull, but with no charge actually being delivered to the subject. Similarly, in the drive stun deployment, if the CEW is not in contact or does not remain in contact with the subject during drive-stun deployment attempt, there will be an X26 CEW download recording of the discharge, despite there not being any actual delivered charge being applied to the subject. Thus, just because the TASER CEW download recorded a trigger pull, does not mean that the CEW was indeed in contact with the subject and delivering the electrical stimulus.

3. *Use of the CEW has been determined to be safe and safer to use than other force options.*

a. Safety Margin

The CEW is the fastest and safest way to attempt to capture, control, and facilitate restraint of many violent and combative suspects while minimizing the stress to the body. Studies across numerous cities show an average reduction in suspect injuries of 65% when the CEW is deployed. CEWs have been applied in over 2,400,000 field and training incidents and are applied at a rate of about 800 times per day. There has never been a death scientifically causally linked to their usage outside of head injury from a fall (or a possible ignition of fire).

CEWs are well recognized for having an impressive safety record. In any of these situations, no reliable scientific or medical evidence was provided that would have supported the notion that TASER CEWs caused fatal cardiac rhythm disturbances. As such, the overall critical cardiac risk of using CEWs is estimated at less than $1/(1,351,891 + 1,514,681) = 0.00000035$, or 1 in 2,866,572 cases. These numbers are consistent with epidemiologic data provided in the scientific research. Thus, according to the research, the safest control method is to use the CEW before physical force. CEWs allow repeated applications as they may be necessary to safely capture, control, and facilitate restraint of a continuously resistant or struggling subject.

The National Institute of Justice found that there is no conclusive medical evidence in the current body of research literature that indicates a high risk of serious injury or death to humans from the direct or indirect cardiovascular or metabolic effects of short-term CEW exposure in healthy, normal, non-stressed, non-intoxicated persons. Field experience with CEW use indicates that short-term exposure is safe in the vast majority of cases. The risk of death in a CEW-related use of-force incident is less than 0.25 percent, and it is reasonable to conclude that CEWs do not cause or contribute to death.

Further it has been reported by risk management groups in two states, numerous police departments tracking the applications of CEW usage and TASER International report that:

- 123,000 lives have been saved,
- Subject injuries have been reduced by about 65%,
- Excessive force litigation claims have been reduced by 75%, and

- Officers injuries and workman compensation claims have been reduced by about 40%

b. Breathing

Numerous human studies have shown that the CEW does not interfere with human breathing. Studies of CEW effects have examined respiration, blood chemistry and the effects on muscle groups. In particular, observation of persons subjected to CEW exposure seems to indicate that muscle groups are affected that fall outside those in the area directly between the darts. Research to date, however, shows that human subjects seem to maintain the ability to breathe during exposure to a CEW and breathing ability is most frequently increased not decreased.

c. Does not create increased stress in subjects

Using a CEW does not create or cause increased stress of a combative subject. Medical research suggests that a single exposure of less than 15 seconds deployed from a CEW X26 or a similar model CEW is not a stress of a magnitude which separates it from the other stress-inducing components of restraint or subdual. There were no cardiac dysrhythmias among healthy volunteers exposed to one discharge of a TASER model X26 for less than 15 seconds following either anaerobic exercise, rigorous exercise or exercise to exhaustion. A study using drive-stun mode on volunteers also failed to show cardiac rhythm disturbances or diaphragm disturbances.

d. CEWs use on subjects under the influence of drugs

It has been hypothesized that a CEW application with someone under the influence of drugs is more likely to sustain an injury or death due to the CEW application. This is a false assertion. There is currently no basis in scientific research to conclude that drug use increases or decreases the safety margin of CEW exposure. It has been suggested that an application can cause a seizure and temporary loss of consciousness. There is no published data that supports this assertion.

e. Multiple applications of a CEW do not create an adverse risk of death.

Only a few studies have actually researched this issue, due to ethical issues. What is known is that CEWs applications do not build up in the body over time. Repeated applications do not cause significant changes in the body chemistry or ability to breathe as mentioned above. People in medical crisis are at a higher risk of sudden death regardless of the police force measures or tools used. It should be recognized that the more a person is at risk of sudden death because of their hyperactivity, the more the CEW or any other police restraint tool or tactic is likely to be used to bring them under control so that they can receive medical attention.

4. Excited Delirium Syndrome (ExDS)

The author refers to the ExDS as a “so called” phenomenon. This is purely misguided to say the least and is erroneous. ExDS is a syndrome most commonly caused by use of stimulant drugs like cocaine, methamphetamine or PCP and presents typically with aggressive and often paranoid behavior, but can also be caused by uncontrolled and untreated psychiatric illnesses, particularly schizophrenia and bipolar disorder. In fact, the original description of ExDS symptoms was in psychiatric patients. And in the days before there were medications to treat these patients, the mortality rate was reported at 75%. Currently, the majority of cases occurs in subjects using illicit

drugs and is a significant cause of sudden cardiac arrest, but psychiatric patients who have been off of their medications also present in and ultimately die from ExDS as well.

Classically, people suffering from ExDS are delusional, are hyperactive, may be violent despite being up against overwhelming force, do not sense pain, often are inappropriately dressed for the conditions, may be sweaty, have elevated body temperatures, and are often breathing fast. They are also often destructive and described as having superhuman strength. Not all of these findings need to be present to define a diagnosis of ExDS.

ExDS places the individual at increased risk for sudden death syndrome, felt by most experts to be caused by an irregularity or stoppage of the heartbeat, caused by the increased stress and work on the heart by the excited, over-stimulated, agitated physical state. There are data that this state is caused by a central brain effect and changes in neurotransmitter receptors. Once the heart goes into an irregular beat or stops, blood flow through the body ceases and shortly thereafter, the subject will lose consciousness due to lack of blood flow to the brain and stops breathing. Often, law enforcement officers will notice that the subject has quieted down, thinking that he has finally calmed down and given up the fight. Then a short time later is when someone will identify that the subject is suddenly in cardiac arrest. An application of the CEW does not increase the risk of a sudden death of these subjects rather the risk of a possible sudden death is caused by deficiencies of the person's internal organs. Research has shown that CEW applications are not a causal factor in the sudden death of the person exhibiting ExDS.

5. *CEW guidelines*

It is acknowledged that there is a risk in using any police tactic or less lethal device. Any use of force measure or equipment can be abused if proper supervision is not provided. Clear guidelines and training should be enacted, prior to adoption, like the police do with other use of force devices. CEWs have been medically researched to show their high margin of safety and the courts in every federal circuit approve their appropriate usage in accordance with *Graham v. Conner* (1989) standards for using objective reasonable force.

Like all restraint tools and tactics, police officers need guidelines in order to appropriately use a CEW. Policies and procedures should be developed which guide officers in their proper application. Administrators should review TASER International guidelines and manufactures recommendations for proper application and maintenance of the device. Administrators should review policy suggestions of their respective state standards (as applicable), the IACP and other police departments in developing their own agency's policy. Appropriate training of all officers should be provided prior to implementation, in accordance with TASER's specifications and supervisors should monitor field usage. Officers should be required to submit a written report of every field use of the CEW. Administrators should also track and research all applications of the CEW and provide an annual report of their application as well as other uses of force equipment and tactics.

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Dr. Ross is the Chair of the Department of Sociology, Anthropology, and Criminal Justice at Valdosta State University and is the Director for the Center for Applied Social Sciences. From 2006 to 2010, he was the Director of The School of Law Enforcement & Justice Administration at Western Illinois University, Macomb, Illinois. From 1992 to 2006 Dr. Ross taught criminal justice courses at East Carolina University, Greenville, NC and was the Director of the Forensic Sciences program. He was the Chair of the department from 1999 to 2002. He was awarded the Scholar of the year award by the ECU Department of Criminal Justice in 2006, the Distinguished Scholar/Professor Award by the ECU Chancellor in April 2004 and in 1997 he was awarded the “Outstanding Teaching Award,” by the NC Criminal Justice Educators Association. From 1985 to 1992 he worked for the Criminal Justice Institute at Ferris State University, Big Rapids, MI. While at CJI he conducted research and provided training for police and correctional agencies, taught subject control tactics, arrest procedures, crisis intervention and responding to the mentally ill, and physical conditioning in the police academy, as a certified MCOLES instructor, and he also taught academic courses at FSU. He was a 13 year veteran with the MI Department of Corrections, working at SPSM as an officer, cell block Unit Manager, a probation officer, and academy instructor. As Unit Mgr. he supervised 16 officers, 2, assistants, 2 psychiatrists, 1 psychologist, and 500 mentally ill prisoners.

Dr. Ross received his Ph. D. from Michigan State University in 1992 and his Dissertation was on “Citizen Resistance During Police Arrest.” He has completed the Executive Management and Leadership Institute at the Kennedy School Government, Harvard University (1999). He has published 85 articles, 4 books, 4 book chapters, and writes articles for PoliceOne.com and CorrectionsOne.com. Elsevier/Anderson Publishing, published his book on *Civil Liability in Criminal Justice* (6th ed. 2013) and Humana Press published he and Dr. Ted Chan’s book on *Sudden Deaths In Custody* (2006). Dr. Ross has performed research on: the outcomes of prone restraint and the use of the TASER; the impact of stress, human factors, and officer perception during lethal force encounters; the impact of stress and contextual cues on human performance and decision making during lethal force encounters; patterns of subject resistance during arrest and during detention; use of force policy development; failure to train and use of force liability issues; the myths and realities of the police use of force; liability issues and sudden in-custody deaths; excited delirium deaths in police custody; restraint asphyxia deaths; liability issues and sudden deaths associated with ExDS, risk factors and unexpected in custody deaths; custodial deaths in jails; administrative liability issues; a risk management analysis of police and detention agencies; liability issues for emergency response teams; prisoner assaults on correction officers; liability issues of suicides in jails and prison. His research has been presented nationally, at Oxford University, Oxford England, in Canada, in Australia, in Hong Kong, and in Taiwan. In 2013, he was inducted into the Michigan State University’s School of Criminal Justice Wall of Fame, as a distinguished alumnus.

Dr. Ross has made over 700 national/international conference presentations on these and other subjects. He has provided consulting and training services for police & correctional agencies, private corporate and security agencies, and the military, nationally and internationally. He has been a consultant to the National Institute of Justice; IL and MI State Police; NC, IL, MI, FL, and OH Training Standards Commission; NC Highway Patrol; NC Justice Academy; GA Chiefs of Police, NC Department of Corrections; NC Jail Administrators; National Institute of Corrections; American Corrections Association; American Jail Association; Alaska Department of Corrections; the Federal Bureau of Prisons; MI Department of Corrections and Jail Services Division; Attorney’s General Office in 6 states; the NC and KS Bureau of Investigation; U.S. Attorney’s General Office in FL; Governmental Risk Managers in 2 states; Hong Kong Correctional Services, Canada and Australia’s Sudden Death Task Force; and Kingdom of Saudi Arabia. Dr. Ross is serving as an expert with DOJ/NIJ’s scientific technology working group on Excited Delirium deaths (ExDS).

Since 1988 Dr. Ross has been retained as an expert witness in over 700 cases providing testimony in 29 states on behalf of police, correctional, and private security agencies. He has testified in state and federal courts, both civil and criminal. He routinely provides testimony in: use of force incidents (lethal & less-lethal), use of force investigations, sudden in-custody deaths, failure to protect in jails, custodial issues in jails/prisons, medical/mental health care and suicide issues in jails, death investigations, and policy, training, personnel, and administrative issues in criminal justice agencies. He has served as a consultant to numerous police and correctional agencies reviewing policies and procedures, internal affairs investigations, officer involved shootings, excessive use of force complaints, custodial death investigations, training issues, emergency response incidents, and wrongful employee discharge incidents. He is a certified police instructor by the GA POST.

Dr. Ross is an Advisory Board Member for PPCT/Warrior Science and is the Director of Research. He was awarded the “Excellence in Leadership Award” by PPCT in 2000. He regularly certifies police, corrections, the military and private security personnel as instructors in these subject control tactics nationally and internationally. He has developed 20 training programs, has made 12 training videos, and has been authorized to provide training in 12 states. He and Dr. Chan provide a 3-day instructor training course on Sudden Deaths in Custody based upon their research.