

WHITE PAPER:

**ELECTROSHOCK WEAPONS (ESWs) AND
PUBLIC SAFETY: THE NEED FOR LAW
ENFORCEMENT AGENCIES (LEAs) TO UPDATE
POLICIES, PRACTICES AND TRAINING TO REFLECT
THE LATEST RESEARCH AND RISKS OF THESE
POTENTIALLY DEADLY WEAPONS**



PROBLEM: Electroshock weapons (ESWs) are “non-lethal” weapons designed to introduce electrical insult into a human body for the purpose of creating pain and incapacitation. U.S. Government reports acknowledge that ESWs were developed anecdotally and not scientifically. Due to the lack of any government standards for safety or oversight, high-power ESWs were introduced into law enforcement agencies (LEAs) in 1999 as “less lethal” options, without the scientific scrutiny or operational performance standards required of less dangerous electronic technologies. The original claims of medical safety and “verification” of electrical safety made by manufacturers and other “independent” reviewers included statements that the electrical output could not affect cardiac or respiratory functions. In fact, one author actually stated, “the Underwriters Laboratory (UL), and the International Electrotechnical Commission (IEC) have published studies that have found that these increases are well within the electrical output safety margin needed to prevent ventricular fibrillation.” These claims of medical and electrical safety responsible for the proliferation of ESWs throughout LEAs worldwide have proven to be false and misleading.

Independent government researchers, leading electrophysiologists, cardiologists, and other medical professionals have since conducted research that clearly contradicts these original claims of safety. Manufacturers themselves have now withdrawn these earlier claims and acknowledge that ESWs can, in fact, capture cardiac rhythm, affect respiration, and lead to death. The latest admissions, warnings, and disclosures by manufacturers regarding the “known and potential side effects” of ESWs have left agencies, officers, and municipalities exposed to civil liability regarding the deployment of these potentially deadly weapons.

While it is a simple effort for manufacturers to issue revised training bulletins, modify warnings, and update disclosures that protect themselves from liability, it is a much more complex effort for agencies and officers to modify their policies, practices, and training to reflect the latest research and risks regarding ESWs. The most challenging issue relative to the latest research and risks is to convince those officers whose training is based on outdated claims of safety that targeting and deployment of these popular weapons has radically changed and can now result in civil and criminal liability for themselves and others.



[This individual] suffered “sudden cardiac death due to [ESW] discharge.” - Vermont State Police, September 2012

SOLUTION: It is timely for LEAs to recognize the need to update all policies, practices, and training for ESWs to reflect the latest research and risks associated with these potentially deadly weapons. For years, law enforcement organizations, institutions, agencies, and officers have focused on the “management” of ESW technologies, but not on the technology itself. This needs to change. Law enforcement executives need to promote a paradigm shift regarding the true understanding of ESW risks throughout their agencies, organizations, and institutions. This paradigm shift needs to start with law enforcement leadership taking a comprehensive approach to understanding that ESWs policies, practices, and training were originally developed based upon inaccurate claims of safety that were not developed through a rigorous scientific approach, nor an independent peer-reviewed process before being introduced, adopted, and deployed. Failure to do so can expose law enforcement executives and officers to accusations of deliberate ignorance and indifference.

Law enforcement executives should mandate an ESW Safety Stand Down Day to conduct safety training that will raise awareness and highlight the proper importance that should be placed upon these new policies, practices, and training. The agenda for this Safety Stand Down should list, analyze, and compare the original, inaccurate, and outdated claims of safety with the latest claims being made by manufacturers. This training should also include basic information about ESW output and the variability that has been found by certified and independent laboratories. Officers need to be made aware that this technology was deployed with no independent formal review, no standards for safety, no standards for performance, and with no way to verify the electrical output discharged from these potentially deadly weapons. An ESW Safety Stand Down Day would also provide an excellent opportunity to introduce the need for measurement of ESWs utilizing an independent standardized measurement method to identify and limit weapon variability, increase officer and public safety by ensuring better reliability and operation. Measurement would also demonstrate to the public that LEAs are proactive, transparent, and accountable in deploying this potentially deadly technology.



This training approach will provide agencies with an opportunity to not only discuss proposed updated policies, practices, and training with officers, but will also solicit insight and input for consideration into the development of these policies. This approach will demonstrate the serious consideration LEAs are giving the latest research and warnings, as well as provide officers with a better understanding of the risks associated with deploying ESW technology on vulnerable populations. Once officers truly understand that the electrical current delivered from these weapons to an individual is not constant, but is, in fact, variable according to the resistance of an individual and can increase as the duration of exposures increase, the warnings, especially regarding vulnerable populations, will have more significance and the paradigm shift will take place much more quickly. This training may also identify the appropriate method LEAs should use when introducing and adopting non-

deadly technologies and related policies, practices, and training in the future. LEAs should develop a practice of adopting non-deadly technologies based upon conclusions from actual scientific research programs and related independent peer-reviewed literature. This is the only way to prevent the wholesale adoption and deployment of non-deadly technologies that do not have the safety research available to define safety thresholds or support

“Training material provided by the manufacturer of [ESWs] and early law enforcement training tended to significantly understate the risks associated with [ESW] use.” - Executive Summary, Maryland Attorney General’s Task Force On Electronic Weapons, December 2009

BACKGROUND: A forensic investigation into the research and history of high power ESWs reveals, quite simply, that these weapons were deployed prematurely and prior to the manufacturer claims of medical and electrical safety being scientifically reviewed and independently confirmed. This conclusion is supported by the fact that the original claims by manufacturers that ESWs could not affect cardiac or respiratory functions are no longer valid. Manufacturer claims that medical examiners and coroners had not found ESWs caused or contributed to deaths are no longer valid. Manufacturer claims that demonstrated “verification” of electrical safety are also no longer valid. The electrical theories of operation” manufacturers utilized to measure and demonstrate the safety 5 – 7 and 26-watt ESWs have actually changed numerous times and are no longer promoted. This is extremely significant given that these “theories of operation” were used to not only demonstrate electrical safety, but also identified the metrics and methods used to measure the electrical energy discharged by ESWs. Individually, these claims of medical safety, verification of electrical safety, and electrical theories of operation were exactly what LEAs relied upon to develop policies, practices, and training as well as to define “appropriate use” in the deployment of ESW technology. Combined, these claims were used to justify the use of ESWs lower on the force continuum as an alternative to non-deadly force options instead of an alternative to deadly force as this technology was originally deployed. Unfortunately, the premature deployment of high power ESWs, especially on vulnerable populations, has resulted in hundreds of deaths, as well as mounting controversy and litigation, associated with this unregulated technology.

GOVERNMENT RESEARCH: Surprisingly, these issues were not unknown prior to the deployment of high power ESWs. In 1999, the National Institute of Justice, Office of Science and Technology (NIJ, OS&T) published The Sticky Shocker Report; a comprehensive report that determined deployment of the original 5 – 7 watt ESWs could result in adverse, irreversible, and unintended consequences, including deaths. This report identified that, overall, there was not enough relevant heart current data available to predict cardiac effects of ESWs, and that it was unclear how electrical currents actually affected the human body. In addition, this report determined that pH levels of the blood could change drastically when electrical current passed through the body, causing acidosis, which could also affect the respiratory system, as well as the heart, and result in death. This report also identified the need to develop a standardized means to measure and predict the electrical current discharged by ESWs. Yet, just three months later, the 26-watt ESWs were introduced unchallenged without any rigorous scientific research or independent



peer review that could validate or challenge the manufacturers' original claims of safety or determine electrical output. Law enforcement was left to rely on nothing more than manufacturer claims, marketing material, and misleading reviews that have since proven to be inaccurate.

In 2003, as the number of deaths related to ESWs increased, the Department of Defense (DOD), Joint Non-Lethal Weapons Directorate (JNLWD) conducted a review of ESW technology that reported there were no known cardiac safety thresholds, dose response data, or metrics for measurement of the 5-7 and the 26-watt ESWs. This report also stated that, "the physiological effects of ESWs were temporal and left no pathology such as gunshot" or knife wounds would. This report questioned how coroners and medical examiners could possibly exclude identifying ESW usage as a causal or contributory factor proximal to deaths. This is a critical point that medical examiners need to focus on when investigating ESW-related deaths. In 2004, the DOD and JNLWD, along with the NIH, OS&T, conducted a risk characterization of ESW technology. This report determined that the UL and IEC electrical standards used by manufacturers for "verification" of electrical safety were actually not even "applicable." This report also identified and confirmed key data gaps in safety thresholds and dose response data, critical for defining and developing policies based upon "appropriate use." While this report identified the need to develop metrics for the standardized measurement of ESW technologies, it failed to even mention the original "electrical theories of operation" manufacturers had utilized to justify electrical safety and measure the electrical current discharged by these weapons. Meanwhile, independent and rigorous scientific research on ESWs began to demonstrate results that contradicted the earlier claims of safety by manufacturers.

"Agencies are concerned that over time, any electronic device could break down." - Doug Klint, Executive VP & General Counsel, October 2009

CERTIFIED & INDEPENDENT LABORATORIES: Beginning in 2001, reports issued and presentations made by certified and independent laboratories utilizing manufacturer measurement methods found that large percentages of ESWs measured were out of specification and that electrical output could vary from weapon to weapon of the same model. These reports disclosed that manufacturers acknowledged "faulty capacitors" could be responsible for weapon variability. Manufacturer executives actually challenged some of the results from certification laboratories even though the manufacturers own measurement methods were being utilized. This was interesting, given that much later one of these same manufacturing executives disclosed, "We really haven't come up with a good way to measure the peak of the voltage." In 2011, another independent laboratory reported that, after controversial ESW deployments, "the first question investigators often ask is whether the [ESW] was functioning properly" and that, "For a more quantifiable examination, the voltage, current, and spark rate must be captured on an oscilloscope. . .". The operating characteristics of ESWs contain critical information for medical examiners to consider whether ESWs were causal or contributory to deaths that occurred proximal to use.

INDEPENDENT INQUIRIES: In 2007, a high profile ESW-related death at Vancouver International Airport in British Columbia, Canada, resulted in the Braidwood Inquiry. The first commission was to report on the use of ESWs in British Columbia, and "to make recommendations respecting their appropriate use." One of these recommendations was for ESW policies to include measurement in order to ensure proper operation, performance, and reliability. Although Judge Braidwood recommended "periodic" measurement, Canadian LEAs decided to measure ESWs on an annual basis, despite manufacturer acknowledgements that electrical output measurements could vary due to "factors beyond their control." The danger in not having developed independent, public oversight of this process becomes obvious when looking closely at several of the elements that were adopted into some measurement programs. Failure to require measurement of the output for the initial

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two years, and the adoption of measurement methods that do not accurately reflect actual ESW deployments are not scientifically, operationally, or legally justifiable. It stands to reason that if the first 5-second discharge of an ESW is what is used on a subject in the field, this is the electrical current that should be measured and recorded. Discharging ESWs for a second and third 5-second time and averaging the last pulses of these discharges against a single resistance is not reflective of the electrical current delivered into an individual in the field. These methods of measurement are certain to be called into question, are indefensible, and will invite future litigation. Measuring only a small portion of an ESW waveform that does not accurately reflect the electrical current being discharged into a subject lacks the accuracy and transparency that measurement was intended to demonstrate and does not promote support from the public, scientific, and legal communities.

While the Braidwood Inquiry was being conducted, the Canadian Broadcasting Corporation (CBC) independently measured a number of ESWs from various LEAs in the United States. A significant number were found to be operating outside of the manufacturer's own specifications. Consequently, manufacturer executives suggested these measurements were flawed while simultaneously changing their own recommended measurement methods, metrics, and terminology.

As a result, questions soon surfaced within the scientific, engineering, law enforcement, legal, and insurance industries regarding the independence, accuracy, and legitimacy of not only the measurement methods used by manufacturers, medical examiners, and others to measure the actual amount of electrical current being discharged by ESWs, but also what part of the waveform was being measured and how it was being measured. Shortly after the CBC report, the Royal Canadian Mounted Police (RMCP) reported that 80 percent of their older ESWs were out of manufacturer's specifications. These ESWs were immediately removed from service.

A Report of the Maryland Attorney General's Task Force on Electronic Weapons was published in 2009. This task force followed the outcry of citizens after an unfortunate ESW-related death of a young black male. While this report acknowledged the valuable role ESWs have in law enforcement, it also stated that, "Training material provided by the manufacturer of [ESWs] and early law enforcement training tended to significantly understate the risks associated with [ESW] use." This report identified the need for LEAs to not rely on these early claims of safety and to constantly update their policies, practices, and training to reflect the latest warnings by manufacturers and researchers.

"I recommend that every [ESW] used by officers...be periodically tested for electrical output..." - Judge Braidwood, June 2009



MEASUREMENT STANDARDS: Also in 2008, independent of these other inquiries, the National Institute of Standards and Technology, Law Enforcement Standards Office (NIST, OLES) initiated the development of rigorous performance requirements for ESWs due to the variability in outputs being reported, the lack of any standardized measurement methods, and the risks associated with these potentially deadly weapons. This included measurement of current, and the high-voltage output of these weapons, calibration of these measurement methods, and computing measurement uncertainties. It was during one meeting with NIST, in 2009, that the senior executive from one ESW manufacturer actually admitted that, “We really have not come up with a good way to measure the peak of the voltage.” This was quite disturbing, given that this same engineer had claimed to have identified the effective range of electrical current delivered in patents, developed product specification sheets, and recommended numerous different measurement protocols to independent entities measuring the high voltage of ESWs during this same timeframe. Another senior executive admitted that measurement of ESWs was a legitimate concern when he stated that, “Agencies are concerned that over time, any electronic device could break down.” And while manufacturers offer measurement options to LEAs, as one researcher stated, “Testing can’t be done by the manufacturer . . . this will be seen as the fox guarding the hen house.”

In 2012, understanding the growing controversy associated with hundreds of “unexplained” deaths, and that standardized measurement methods were needed to characterize ESW output, the International Electrotechnical Commission (IEC) created IEC PT 62792: ESW Measurement Method. This IEC standard was developed to become the internationally recognized and accepted method for the safe, accurate, and reliable measurement of ESWs. The inclusion of regular standardized and mandatory measurement of ESWs in updated policies, practices, and training will develop a historical performance base and protect officers and LEAs from civil litigation that could occur from deploying weapons that discharge too much or not enough electrical current. Both can lead to negative and unnecessary outcomes, and given that manufacturers now acknowledge ESWs can discharge electrical current outside manufacturers specifications, it is critical that LEAs protect themselves, their officers, and the public by being able to measure these weapons prior to use. Measurement should be absolutely mandatory for LEAs that have decided to deploy ESWs that are outside of the manufacturer recommended life cycle. In addition, it is critical that medical examiners record valuable and, potentially, key information from ESWs used proximal to deaths. Often, ESWs are not sent off for measurement until many months after these deaths. As a result, this valuable information can be compromised. Additionally, by this time the medical examiners or coroners have often already formed an opinion as to the cause of death without even measuring the ESW, or considering these weapons or low power electrocution as being causal or contributory factors. The IEC PT 62792 will provide manufacturers of ESWs and all stakeholders, researchers,



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laboratories, LEAs, industry associations and organizations, insurance providers, city and risk managers with the necessary guidance to independently and accurately measure ESWs for proper operation, performance, and reliability. Utilizing this standardized measurement method will also provide the opportunity to use these results to develop weapon performance history, identify trends and limitations in these technologies, as well as initiating scientific epidemiological studies in ESW-related deaths instead of simply conducting administrative anecdotal reviews of these unfortunate and, often, unnecessary outcomes. Given that the IEC is the international authority recognized for developing standards for any product that produces, uses, stores, or transfers electrical power, LEAs should have confidence in the accuracy and validity of the measurement method and include it in their ESW policies, practices, and training. The benefits of doing so are numerous and will engender much more confidence from the public than simply sending ESWs back to the manufacturer for measurement.

“Testing can’t be done by the manufacturers . . . this will be seen as the fox guarding the hen house.”

- Andy Adler, Professor, Carleton University, October 2012

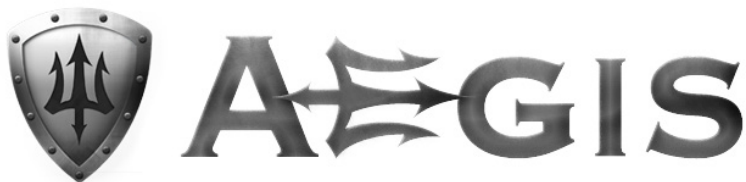
ESW manufacturers have had a long history of not providing any scientific research or independent peer reviewed literature on the medical and electrical safety of their latest technologies prior to their introduction to LEAs. Manufacturers also have a long history of not publicly providing the complete electrical output specifications for ESWs, not identifying the metrics used for measurement, the measurement methods utilized to determine electrical output, or exactly which part of the waveform is being measured. Manufacturers have also discouraged agencies from measuring these weapons themselves, even though manufacturer disclosures acknowledge that the electrical measurement of ESWs can vary due to “factors beyond their control,” a fact that certification and independent laboratories have reported to manufacturers for years.

These points are critical for law enforcement executives to consider and understand. First, these points reveal the exact reasons ESWs should be measured. Second, these points confirm the need for LEAs to utilize a standardized measurement method for ESWs that reflects the manner in which these potentially deadly weapons are deployed and not some arbitrarily developed measurement specification. Third, ESWs should be measured utilizing several resistances. This will provide a more accurate characterization of the electrical output of a weapon than measuring it against a single resistance. It will also show officers that ESW output does vary, an important fact they need to be aware of when deploying these on subjects. Fourth, if manufacturers require “spark tests” for their ESW’s, this information should be captured, measured, displayed, recorded, and stored. LEAs and officers need to truly understand the purpose of the “spark test.” If the purpose of the “spark test” is to “condition” a circuit, LEAs and officers should know how long a circuit remains “conditioned.” Fifth, recent “smart” weapons include Built-In-Test-Equipment (BITE). While BITE features may check circuit connectivity, agencies should not be misled into believing this is a replacement for independent measurement of the electrical output delivered against multiple resistances. In addition, the only way to ensure that these “smart” weapons are, in fact, constant current, is to measure them utilizing multiple resistances. Sixth, measurement of ESWs can prevent unintended consequences, including deaths, from occurring by preventing unreliable weapons from being deployed. Seventh, ESW performance data can be extremely useful information for later research and/or investigations, as well as protecting the LEAs investment in this technology. The only sure way to quickly and accurately know the electrical output of ESWs at a local level is to measure the electrical output utilizing an ESW Waveform Analyzer.

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CONCLUSION: The public will not continue to accept a lack of accountability for the electrical output of these potentially deadly weapons, especially given their growing use on vulnerable populations such as children, the elderly and those in mental health crisis. Appropriate use of ESWs begins with measurement. Deploying potentially deadly weapons with no recognized standards for safety, measurement, or operational performance, and not knowing if these weapons are operating within a manufacturer's specification is dangerous. Given that the federal government has failed to establish standards for the safety and performance, states should develop standardized policies, practices and training for these weapons. Best practices for radar guns, breathalyzers, and window tinting testers includes measurement for proper operation and reliability. ESWs are no different and should be measured as well. After all, ESWs are not simply another electronic device, but a potentially deadly force option designed to save lives, not cause or contribute to deaths. Updating LEA policies, practices, and training for ESWs is a complex effort. However, effectively identifying and implementing the latest research and warnings associated with these potentially deadly weapons will minimize risks and mitigate liabilities. Conducting a formal ESW Safety Stand Down Day will benefit officers, agencies, and the public they serve and protect.

"The appropriate use of ESW technologies begins with standardized scientific measurement." - Ken Stethem, CEO AEGIS, May 2008



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