



## Medical Panel Issues Interim Findings on Stun Gun Safety

by John Morgan, Ph.D.

**D**uring the three-year period from 2003 to 2005, 47 states and the District of Columbia reported 2,002 arrest-related deaths to the Bureau of Justice Statistics' Deaths in Custody Reporting Program.<sup>1</sup> For many years, police leaders have sought alternatives to lethal force and better methods to subdue individuals to limit injuries and death.

Less-lethal devices have been used by law enforcement for decades; during the early 1990s, pepper spray became the less-lethal option of choice for law enforcement and corrections agencies. Although pepper spray is inherently safer than lethal-force options and may be preferable to blunt-force methods, many advocates were concerned that pepper spray was associated with in-custody deaths. The National Institute of Justice (NIJ) reviewed those cases and, in 2003, issued a report that found pepper spray was safe and effective.<sup>2</sup>

In recent years, electro-muscular-disruption technology — also known as conducted-energy devices (CEDs) or stun guns or by

the trade name Taser<sup>®</sup> — has become the less-lethal device of choice for a growing number of law enforcement agencies. CEDs use a high-voltage, low-power charge of electricity to induce involuntary muscle contractions that cause temporary incapacitation. Industry reports suggest that approximately 11,500 law enforcement agencies around the country have acquired CEDs, with approximately 260,000 devices now deployed. In 2003, TASER International introduced the Taser X26<sup>®</sup>, the conducted-energy device most widely used by law enforcement today.

Although studies by law enforcement agencies have found that the deployment of CEDs reduced injuries to officers and suspects,<sup>3</sup> a significant number of individuals have died after CED exposure. Some were normal healthy adults; others were chemically dependent or had heart disease or mental illness. These deaths have given rise to questions from law enforcement and the public regarding the safety of CEDs.

Because many gaps remain in the body of knowledge with respect to the effects of CEDs, NIJ sponsored an independent research program to address the safety and effectiveness of CEDs and a study to address whether CEDs can contribute to or cause mortality and, if so, in what ways. An interim report on this study was recently released. *Deaths Following Electro Muscular Disruption* is available at <http://www.ncjrs.gov/pdffiles1/nij/222981.pdf>; a final report is expected in 2009.

The study is being conducted by an expert medical panel assembled by NIJ. The panel reviewed the full range of current scientific research, reviewed a number of CED-associated deaths and held substantive discussions with industry, academia and community advocates. At this time, many questions about the safety of CEDs cannot be answered based on current research, especially with respect to at-risk individuals. Nonetheless, although exposure to CEDs is not risk free, NIJ's medical panel found no conclusive medical evidence in current research that indicates a high risk of serious injury or death from the direct effects of CED exposure.

## NIJ's Research Program

Prior to NIJ's involvement, most of the relevant research in this field had been industry sponsored. Although much of this prior work had been published in peer-reviewed journals, some questions had been raised about the influence of industry funding on the results. For its CED safety studies, NIJ funded researchers, physicians and other professionals who have never been employed by companies in the field, including TASER International, Inc.<sup>4</sup> Device manufacturers did cooperate with and provide important information to NIJ-sponsored researchers and studies.

NIJ's research program has included three main types of study. In general, physiological research provided a controlled way to examine the limits of CED exposure and how such exposure might affect at-risk populations, such as individuals with high body temperature or who were compromised

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by drug exposure.<sup>5</sup> Human subject testing was performed with police volunteers during training to determine the effects of CED exposure on healthy individuals, especially with respect to changes in heart function and blood chemistry. Field data collection provides information about how CEDs are used and how they affect a range of individuals in real-world settings. Some field data were retrospective, based on reconstruction of information in police reports. Other field data were collected by medical personnel soon after the use of CEDs by law enforcement.<sup>6</sup>

These studies have improved the understanding of the safety and effectiveness of CEDs. Researchers at the University of Wisconsin found that CEDs can directly "electrocute" the heart rhythm, although the chance of this happening is quite small.<sup>7</sup> Theoretically, this can happen only in individuals with very little distance from their skin surface to their pericardium, the sack around the heart muscle. Research published in 2007 shows that CEDs can cause heart fibrillation (a dangerously disturbed heart rhythm) in people with pacemakers, presumably because the CED shock can travel down the electrical leads of the pacemaker device.<sup>8</sup>

One concern with CEDs has been that they cause involuntary muscle contractions and thus might cause muscle breakdown, changes in blood chemistry, and perhaps resulting heart failure. Physiological testing has not shown significant signs that these problems actually occur.<sup>9</sup> CED exposure can cause a small, temporary increase in lactate, similar to what might be seen during moderate exercise. This result confirms industry studies.

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## Cases of Excited Delirium

Supporters of the use of CEDs attribute many in-custody deaths to a syndrome called excited delirium. Excited delirium is not a medical diagnosis, but a term describing people who may have psychosis or drug intoxication. These individuals may show great strength, agitation and violent behavior. Their body temperature will often be very elevated, to potentially lethal levels.

Law enforcement officers encounter suspects in excited delirium frequently and must use force to subdue them. People in excited delirium are at high risk of death even if they do not encounter a police officer and even if a CED or other weapon is not used against them. These individuals must be calmed and their body temperature reduced as soon as possible to avoid sudden death.

Although preliminary data from physiological studies suggest that CEDs may increase the risk of sudden death in cases of excited delirium, NIJ's study panel concluded in its interim report that CEDs do not directly cause death in excited delirium cases. The panel noted that this does not mean that CEDs are entirely ruled out from having a role in such deaths. Everything that happens to a person that causes excited delirium and stresses a person in excited delirium may be a contributing factor in his or her

death, whether he or she ingested drugs or engaged in a physical struggle.

Many police departments are working with emergency medical responders to deal with excited delirium cases more effectively. In Dade County, Fla., responders have implemented protocols based on Canadian research to reduce the risk of death in these individuals. Interventions include sedation with the drug Versed and reduction in body temperature using chilled intravenous fluids. Although not recommending Dade County's protocol specifically, NIJ's interim report on in-custody deaths does support active intervention in excited delirium cases, which may include cooling, sedation and hydration.

## The Panel's Recommendations

As stated earlier, the NIJ medical panel noted that, at this time, many questions about the safety of CEDs cannot be answered based on current research, especially with respect to at-risk individuals. The panel found, however, that there is no conclusive medical evidence to indicate a high risk of serious injury or death from the direct effects of CED exposure. In fact, field experiences in many police departments indicate that exposure is safe in the vast majority of cases.<sup>10</sup> Therefore, the panel said, law enforcement need not refrain from deploying CEDs, provided the devices are used in accordance with accepted national guidelines. (See *Electronic Control Weapons*, a model policy of the International Association of Chiefs of Police.<sup>11</sup>)

The panel's interim report includes significant recommendations for post-event medical care and investigation of in-custody deaths. It is not possible, the panel said, to reach a definitive conclusion concerning the role of less-lethal devices in a death unless the relevant facts have been established about the incident and the decedent. The report also includes a bibliography of scientific papers that have been systematically reviewed for their relevance and quality. This bibliography represents an authoritative foundation for the inclusion or exclusion

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## About the Author

John Morgan is the Deputy Director for Science and Technology at the National Institute of Justice. He co-chaired the Steering Group of NIJ's study, *Deaths Following Electro Muscular Disruption*.

of CEDs in deaths. Although it does not include every possible source of information, the bibliography does represent a reliable set of information accepted by the NIJ medical panel.

NIJ's review of CED technology provides the needed basis for the appropriate use of these devices. The legitimacy of law enforcement is, in part, derived from the care taken in choosing technology to subdue or suppress individuals. NIJ plays an integral role in this process by developing knowledge about a wide range of technology and practice — including this recent interim report on conducted-energy devices — based on rigorous scientific research.

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### For More Information

- Information on less-lethal technologies and NIJ's work in this area is available at <http://www.ojp.usdoj.gov/nij/topics/technology/less-lethal/welcome.htm>.

### Notes

1. Mumola, C.J., *Arrest-Related Deaths in the United States, 2003-2005*, Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, October 2007 (NCJ 219534), available at <http://www.ojp.usdoj.gov/bjs/pub/pdf/ardus05.pdf>.
2. *The Effectiveness and Safety of Pepper Spray*, Research for Practice, Washington, DC: U.S. Department of Justice, National Institute of Justice, April 2003 (NCJ 195739), available at <http://www.less-lethal.org/docs/59/NIJ-Effectiveness-of-Pepper-Spray.pdf>.
3. See, for example, <http://www.seattle.gov/police/publications/forg/community.htm>.
4. Dr. Cynthia Bir, who presented information to NIJ's medical panel, tested and evaluated Stinger CEDs with funding received from Stinger in 2006. Bir is currently researching the development of new models to replicate excited delirium.
5. Webster, J.G., J.A. Will, H. Sun, J.Y. Wu, A.P. O'Rourke, S.M. Huebner, and P.S. Rahko, "Can Tasers® Directly Cause Ventricular Fibrillation?" *International Federation for Medical and Biological Engineering Proceedings* 14 (2006): 3307-3310.
6. Bozeman, W.P., J.E. Winslow, D. Graham, B. Martin, W.E. Hauda, and J.J. Heck, "Injury Profile of Electrical Conducted Energy Weapons," *Annals of Emergency Medicine* 50 (3) (September 2007): S65; Mesloh, C., M. Henych, L.F. Thompson, and R. Wolf, *A Qualitative and Quantitative Analysis of Conducted Energy Devices: Taser X26 vs. Stinger S200*, final report submitted to the National Institute of Justice, Washington, DC: May 2008 (NCJ 222769), available at <http://www.ncjrs.gov/pdffiles1/nij/grants/222769.pdf>; and Mesloh, C., M. Henych, and R. Wolf, *Less Lethal Weapon Effectiveness, Use of Force, and Suspect and Officer Injuries: A Five-Year Analysis*, final report submitted to the National Institute of Justice, Washington, DC: September 2008 (NCJ 224081), available at <http://www.ncjrs.gov/pdffiles1/nij/grants/224081.pdf>.
7. Webster et al., "Can Tasers® Directly Cause Ventricular Fibrillation?"
8. Cao, M., J.S. Sinbane, J.M. Gillberg, and L.A. Saxon, "Taser-Induced Rapid Ventricular Myocardial Capture Demonstrated by Pacer-maker Intracardiac Electrograms," *Journal of Cardiovascular Electrophysiology* 18 (8) (August 2007): 876-879.
9. Chan, T., C. Sloane, T. Neuman, S. Levine, E. Castillo, G. Vilke, K. Bouton, and F. Kohokorst, "The Impact of the Taser Weapon on Respiratory and Ventilatory Function in Human Subjects," *Academic Emergency Medicine* 14 (5 Supplement 1) (2007): S104.
10. Bozeman et al., "Injury Profile of Electrical Conducted Energy Weapons," S65; and Mesloh et al., *Less Lethal Weapon Effectiveness*.
11. *Electronic Control Weapons Model Policy*, Alexandria, Va.: International Association of Chiefs of Police, National Law Enforcement Policy Center, August 2005.