

**Document Title:            Evaluability Assessment of Conducted  
Energy Devices (CED)**

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## **Evaluability Assessment of Conducted Energy Devices (CED)**

**Staff Contact:** Lt. Mike Fish  
MPO Chuck Ponsart  
Fairfax County Police Academy  
14601 Lee Road  
Chantilly, VA 20151  
(703) 449-7212

Lt. Paul Hicks  
Internal Affairs  
Fairfax County Police Department  
(703) 246-2564

### **NIJ Guidance**

The National Institute of Justice (NIJ) does not recommend an outcome evaluation of Conducted Energy Device (CED) technology in the site assessed below. NIJ remains interested, however, in evaluating the impact of CED's in other sites where a prospective time series design is possible with multiple pre- and post- measures. Applicants who propose to evaluate this technology are encouraged to consider outcome variables related to officer safety, public safety, and accountability. Applicants should note that NIJ already supports a number of research projects related to CED technology, as described below.

Applicants may depart from this guidance by providing appropriate rationale.

**1. Technology Summary:** The Fairfax County Police Department has 253 X26 Taser® conducted energy devices (CEDs) available for deployment to 1081 of its officers who have been trained in the use of this device. The X26 is reportedly the third generation of CEDs that have been made available by Taser International, the primary manufacturer of such devices. It differs from earlier generations in that it does not just emit pain through electrical impulses; it also restrains resistant suspects through neural muscular incapacitation. The handgun styled device fires two dart-like “probes” under nitrogen propulsion when activated. These probes are attached by wires to a battery in the weapon that will emit an electrical charge into suspects at 50,000 volts but with less than .004 amps. The normal impulse time is 5 seconds but longer times can be instituted by an officer maintaining compression on the weapon's trigger. The short duration is considered a long enough incapacitation period to permit the application of physical restraints, such as handcuffs, on the unruly suspect. The device can also be used to apply a direct electrical pain impulse to a suspect by applying the tip of the device directly to a suspect's skin. Maximum range for the probes of the X26 device utilized is 21 feet.

Use of the device is strictly governed by written departmental policy and is monitored by Internal Affairs. Officers are not permitted to use the device until after completing an 8-

hour Taser-approved certification course. Use is also restricted to those circumstances along the use of force continuum above voluntary handcuffing. That is, it can be deployed to counter active resistance to officer directions and/or apprehension. In this regard, using a CED is considered equivalent to using other less-lethal weapons, such as pepper spray (OC) or a baton, both of which are also available for use by patrol officers in such circumstances. However, a perceived difference is the distance from which CEDs can be used in comparison to other less lethal weapons. Use is prohibited against pregnant females and children. While the device is considered to be safe in terms of the application of electrical current into suspects, its muscular incapacitation effects result in widespread muscle contraction, causing suspects to become rigid and fall to the ground. Physical injury is possible due to such falls. Minor injury also results from the probes puncturing the skin and removing them, as the ends of the probes are equivalent to small fish hooks. Under normal circumstances, officers themselves remove the probes and sanitize the small entry wounds. Exceptions to this practice include when the probes inadvertently puncture parts of the face, genital areas, buttocks or female breasts. In such circumstances, suspects are transported to a hospital for probe removal.

The CEDs are issued to officers at their station or substations prior to duty. Individual officers do not have their own devices – they are shared across multiple patrol officers.

### **Scope of Evaluation:**

**a. Summary of Evaluability Assessment Activity:** The assessment of the feasibility of evaluating CEDs began with a literature review and a Web-based search to identify vendors of CEDs, the most prominent of which is Taser® International. The researchers also contacted technology experts at the National Law Enforcement and Corrections Technology Centers (NLECTC), and held conference calls and personal interviews with NIJ Program Managers from the Office of Research and Evaluation and the Office of Science and Technology.

The literature review, telephone interviews, and conference calls revealed that CED technologies are relatively mature in the field of law enforcement but are still considered controversial by some outside of law enforcement. A substantial amount of medical research has been conducted to test the safety of CEDs. However, very little is known empirically about the effects of CEDs from a social science perspective. It should be noted that there are several NIJ evaluation studies currently underway (see descriptions under the “Literature Review” section below).

The Urban Institute’s initial screening identified a number of mature law enforcement applications of CEDs around the country. UI originally sought to conduct a site visit to Minneapolis based upon NIJ recommendations. However, attempts to schedule such a visit proved ineffective. Several other departments were subsequently contacted based upon NIJ recommendations.

On the basis of the screening information compiled, UI and NIJ mutually decided that Fairfax County would be the location for a further site visit screening. An important

consideration was the fact that the department is currently using an advanced version of CED technology.

**Finding:** A scientifically rigorous outcome evaluation of the Fairfax County CED application would be difficult at present. The technology is available to most officers for normal patrol use, as well as for SWAT and internal affairs. Thus, comparison groups could not be established within this department, nor could random assignment. However, a comparative outcome study of CEDs to OC and batons would appear to be worthwhile. In addition, if a similar department not deploying CEDs could be identified, a pre- post-comparison group design to measure outcomes could be employed. This would likely be difficult as a very large proportion of departments, particularly large ones, have already deployed CEDs.

## 2. Brief Literature Review

### **What do we already know about projects like these? Would this evaluation add to what we know?**

There has been a substantial amount of media attention focused on the use of CEDs by law enforcement officers, some of which is critical of the technology or has sensationalized individual cases (i.e. the recent removal of a disruptive student from a presidential campaign speech, or use on very young children). Perspectives on moral and ethical issues have also been published, as have legal aspects (Fitterman, 2007).

Probably the largest body of research concerning CEDs has focused on the medical consequences of the use of this technology. Taser® International's website ([www.taser.com](http://www.taser.com)) provides summaries of some of this literature. Cited studies include those conducted by police departments in Madison, Cincinnati, and Orange County, FL and by law enforcement advisory boards in Michigan and Wisconsin. Fifteen "general" research studies focusing on the physiological effects on humans are also cited, as are studies by the General Accounting Office and three other government sponsored physiology effects studies. The conclusions suggest that CEDs are effective in immobilizing suspects when used properly, although there are risks of injury or possibly death, albeit quite small.

In light of the controversies surrounding CEDs, NIJ is currently supporting several safety studies. These include: 1) a review of deaths following electro-muscular disruption; 2) a study by the International Association of Chiefs of Police (IACP) on the chain of events surrounding CED use; 3) a study by the University of Wisconsin on CED effects on internal organs; 4) a Wake Forest study monitoring CED cases that result in hospital transport; and 5) another Wake Forest study on incidents of excited delirium resulting from CEDs (NIJ, 2008). In addition, three social science oriented studies are currently underway, as reported by NIJ's Office of Research and Evaluation. These focus on medical outcomes, legal consequences and policy/legal issues surrounding CEDs. Results of these NIJ research efforts have not yet been disseminated to date, however.

## **What audience would benefit from this evaluation?**

The primary beneficiaries would be local law enforcement and corrections policymakers, administrators, and investigators. An evaluation would also contribute significantly to empirical knowledge about the use of technology to improve apprehension efficiency and effectiveness outcomes, as well as reducing injuries to suspects resisting police commands or apprehension. Studying potential reduced officer injuries from defensive use would also inform the field and contribute to knowledge about this technology. Federal funding agencies would also find the results of an evaluation useful for policy and program development.

### **3. Level of Site Cooperation**

Fairfax County Police Department has participated in safety research projects in the past and is currently collaborating on a medical study of the effects of CEDs by Wake Forest University. There has been no formal social science evaluation to date and plans for future evaluations were not discussed. It did appear, however, that the department would be open to a social science evaluation.

### **4. Background History**

Implementation of this technology began several years ago in Fairfax County. The department has progressed through several technology generations, as well as training curricula. It currently deploys the third generation X26 devices and they are available to officers on request throughout the department. The vast majority of officers have been trained and certified in X26 CED use.

### **5. Program Design**

#### **Target Population**

The target population is suspects or other individuals encountered by law enforcement officers in the field, who actively resist officer commands or apprehension attempts.

#### **Project Goals and Objectives**

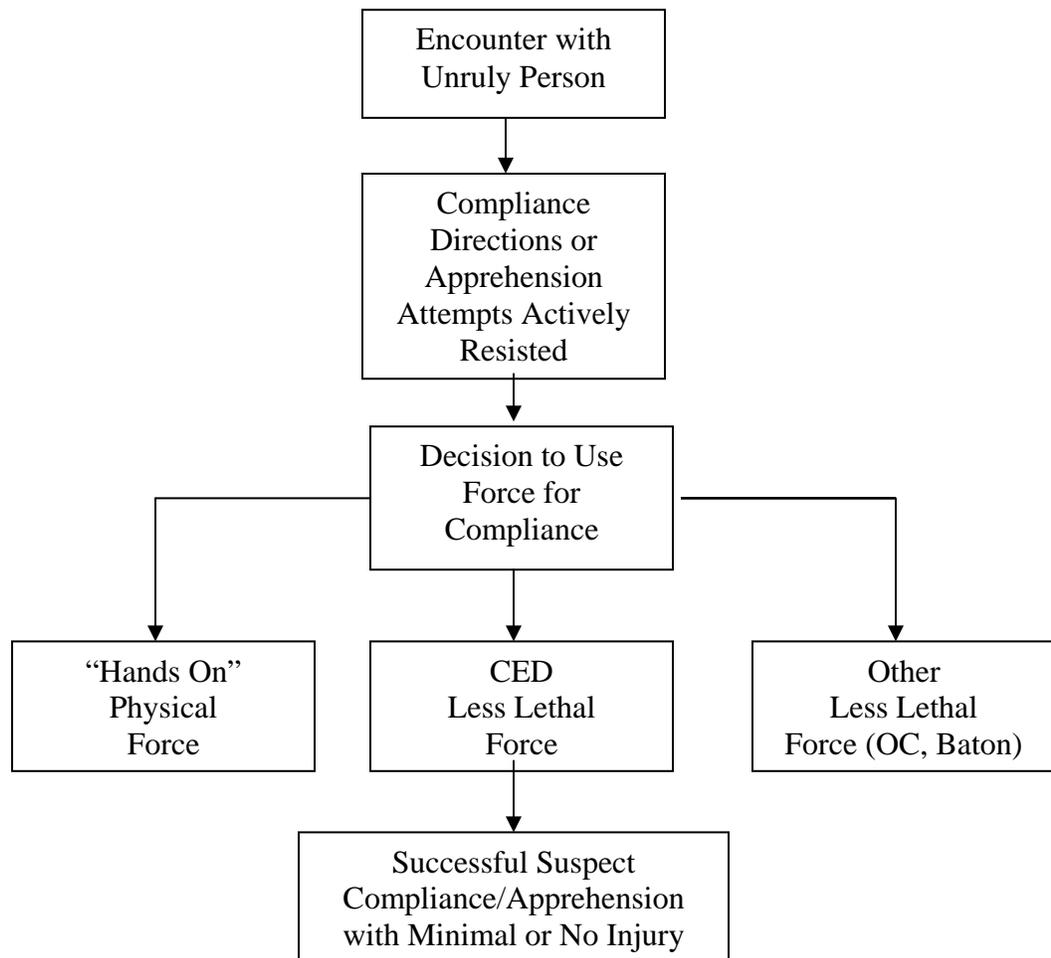
The goals of the use of this technology are to reduce injuries of suspects and officers in cases of unruly or resistant encounters in the field. The objectives within a patrol field setting are to: 1) Successfully incapacitate and control unruly and resistant individuals where use of force beyond voluntary compliance or handcuffing is necessary; 2) Prevent injury to potential victims of crime when force is necessary but lethal force is not authorized; and 3) Prevent injury to officers in circumstances where defensive force is necessary but lethal force is not authorized.

### **6. Program Logic Model**

Exhibit 1 presents the basic CED technology logic model. Under this basic model this technology is designed to be utilized in encounters with unruly or non-compliant persons either defensively in the case of attack, or offensively to stop aggressive behavior. Where verbal instructions are ineffective and an individual becomes actively resistant, an officer is authorized to use additional force along the use of force continuum. Lethal force is obviously not permissible under such circumstances. However, “hands on” force can be applied, or one of several “less lethal” force options can be employed. These include pepper spray (OC), a baton, or a CED. Theoretically, at least, CEDs are effective in incapacitating disorderly suspects in order to effect handcuffing, compliance and/or arrest. In addition, it has been postulated that the use of CEDs minimizes injury risk and outcomes, including physical injury to both officers and suspects.

**Is the logic supportable by empirical evidence?**

**Exhibit 1 – CED Logic Model**



The extant literature, including independent studies to date, is summarized on the Taser® International website. In particular, a significant amount of medical research is presented in support of the safety and effectiveness of this technology. In addition, within its training curricula for police departments purchasing its devices are numerous videos are included that support the CED logic model by demonstrating safe incapacitation effects in both training and real life scenarios.

**Are there apparent contradictions or conflicts between certain activities and the outcome expected?**

The use of this technology as a tool for law enforcement to insure safe compliance and for self defense appears logical and is well supported by the evidence, at least currently available research. However, compliance effectiveness and safety in comparison to other use of force options is less well documented. For example, whether the threat of using pepper spray is more or less effective than the threat of the use of CED appears to be an open question. In addition, several unanticipated outcomes might be possible. Reliance on CEDs could reduce the use of verbal persuasion or potentially less painful “hands on” compliance techniques. Similarly, these hypotheses have not been tested.

**7. Implementation Issues**

**Is the project being implemented as planned?**

Discussions with police department trainers and a commander from internal affairs suggested that the implementation of this technology has been consistent with departmental plans.

**Describe staffing.**

Currently there are approximately 1,081 police officers who have been trained and certified in the use of CEDs with this police department, or approximately 90% of all officers. A total of 253 devices are available for use through issuance at police stations and substations. While carrying CEDs is voluntary for an individual officer, enough devices are currently available for almost all officers on duty at a given time to be so equipped.

**Describe the stability of the project over time**

The implementation of this technology is mature in the Fairfax County Police Department. Current plans are to update the training curriculum to the latest Taser® version. However, the vast majority of officers are trained, and use of force incident

reporting and downloading of individual CED unit data have become routinized within the department.

### **What aspects of the project could be evaluated for outcome?**

There are several outcome designs worth considering for an evaluation of CEDs within police patrol environments. The first would be a post-only design that examines CED outcomes to other less lethal approaches, such as pepper spray. This would require the retroactive collection of incident data, although in the case of Fairfax County at least, the extent and validity of such data appears quite good. A second approach would be a post-only study of CED injuries and hospitalizations. Current research is examining these issues too, although those results are not yet available. Another important outcome that could be measured might be the deterrent effects of simply displaying the weapon and gaining compliance without actually having to induce the electrical charge. This would necessarily also have to be a post-only design given implementation maturity in Fairfax County and many other departments across the country.

An alternative and more rigorous outcome evaluation design might be feasible if a similar police department could be identified that has not yet deployed CEDs. It could be used as a comparison department and CED events could be examined over time in the target department and then compared to outcomes of other means of gaining suspect compliance in the comparison department. In addition, if another department could be identified that is planning to implement this technology in the future a pre- post comparison design might be feasible.

Two options exist for comparison areas. One design would restrict implementation to randomly selected areas of the jurisdiction (precincts or districts, for example). Those areas would become the experimental areas and the other areas would be controls. Another alternative for this design would be only equipping a subset of all officers with CEDs and not allowing use by other officers. Under both options, pre-post and longitudinal time series outcomes could be compared. It should be noted, however, that maintenance of such quasi-experimental designs would likely be a challenge for researchers given the practical influences that could arise and threaten the maintenance of true comparisons. For example, in the latter design CED-equipped officers could back up non-equipped officers and use this level of force, regardless of the evaluation design. The biggest challenge for these more rigorous designs, however, would be finding departments large enough to yield sufficient use N's but that have not yet deployed the technology. Some have estimated that the majority of police departments in the United States have already deployed CEDs (Fitterman, 2008).

### **What would the outcome measures be?**

Efficiency and effectiveness outcome measures would include incidence of compliance or apprehension with minimal injury in comparison to other methods of incapacitation or apprehension. Injuries incurred as a result of being subject to CED deployment could also be examined, as could hospitalizations. The reliability and consistency of CED

effectiveness in rendering subjects immobile and deterrence of resistance effects could also be assessed. Intermediate outcomes such as compliance with departmental policies and internal affairs investigative findings are also alternatives. Of course, most of these outcome measures are currently included in ongoing studies, but given the limited emphasis on social science outcomes, additional studies examining such CED effects appear warranted.

### **How could an appropriate comparison group be created?**

Naturally occurring comparison events in a single department would be other types of use of force. It is not known how many such incidents occur and they may, in fact, be quite small if large proportions of officers are issued this technology, as is the case in Fairfax County. As noted above, internal comparison groups could be created in a startup agency by restricting use of CED technology to selected geographic areas within the agency's jurisdiction and using other areas within the jurisdiction as comparison groups. Alternatively, another similar law enforcement agency could be recruited for comparison purposes. Again, however, given the large proportion of departments already deploying CEDs, these options are likely to be quite difficult to achieve.

### **Are the sample sizes statistically significant?**

The availability of outcome data in Fairfax County suggests that sampling would not be required. This would be particularly true in patrol environments, as use of force incident reports are completed and maintained for the entire population of incidents.

### **Is random assignment possible?**

Not for a post-only outcome design within a department already using CEDs. However, for new departments patrol comparison areas could be randomly generated. Randomization of the issuance to individual officers or deputies in a start up agency might be feasible, although randomization could easily be negated through normal patrol back up operations and multiple officer responses to dangerous situations.

### **Recommended Approach**

It is recommended that NIJ support a post-only design in either Fairfax County or another jurisdiction with mature implementation of CEDs. Little research on outcomes has been conducted, in contrast to medical effects, and would be worthwhile given the current controversies surrounding CEDs.

### **Alternative Approach**

Alternative approaches could include comparison group designs. In particular, pre-post-approaches would be more scientifically rigorous, although extremely difficult to implement and maintain.

### **What strengths and weaknesses do the designs have?**

Both the recommended and alternative designs suffer from the typical threats to validity associated with non-experimental approaches. Their primary strength is the generation of knowledge on which to base future research efforts in an area where very little is known from a social science perspective.

### **How long in duration would the evaluation be?**

It is estimated that a post-only study of implementation and outcomes could be accomplished within 18 months. A pre-post comparison group study of efficiency and effectiveness in a jurisdiction just beginning the implementation of CED technology would likely take an additional 6 months or more. This would be primarily due to the extra time required to identify and recruit a comparison area or agency and to collect and analyze new data.

### **What would be the estimated cost?**

A pre-post comparison group study of a CED application is estimated to require \$325,000–350,000 because of new data collection requirements or startup recruitment costs associated with use of a comparison agency. The least costly would be the post-only case study of Fairfax County or another mature application agency. Some new data would need to be collected, but current data systems appear more than adequate. Estimated costs for this approach would be in the \$175,000-250,000 range.

### **What aspects of the project make an evaluation more difficult?**

For the pre-post comparison group design, site recruitment, data access, and gaining buy-in for an evaluation, particularly from a comparison agency, if one is used, could present obstacles. Maintenance of non-use in comparison areas in a single jurisdiction would also be a challenge, as would issuance to only an experimental group of officers. A post-only case study would be the least challenging, but would still require agency and researcher data collection demands.

## **8. Measurement Model**

The efficiency and effectiveness outcomes and intermediate decision making outcome measures are summarized in the logic model (exhibit 1). These include officer decisions to use less lethal force, choice of force instruments or technologies and indicators of success in facilitating apprehension and minimizing injury to both suspects and officers.

## **9. Data**

**Comment on the quality and availability of project-generated data to support these measures.**

The Fairfax County Police Department maintains detailed circumstance and outcome data for all use of force incidents. These data are maintained in an Access database and can easily be extracted for analytical purposes. In CED deployment cases additional data are collected beyond the standard use of force report information. In addition, this particular device contains a memory chip upon which data unique to the individual weapon are stored. This includes time, date, duration, temperature and battery status at time of firing. These data can be downloaded through a USB data port for analytic purposes as well. However, these data are encrypted and required unique software for extraction and summation. Both sets of data can be cross referenced to individual officers, stations and RMS incident and arrest data as well. Records of medical treatment, if required, appear to be available, but probably only in hard copy formats.

**Can services delivered be identified?**

Delivery of services is not an element of this technology application.

**Can target population be tracked over time?**

The current population of technology use events can be very accurately tracked over time.

**Would an evaluation have to generate new or additional data?**

Regardless of the design employed, new additional data would have to be collected. Such data might include suspect perceptions, deterrence event indicators (threat, but non-use incidents) and potentially alternative less lethal outcome event data. In the case of designing a study in a department just beginning CED deployment, data collection instrumentation and databases would necessarily have to be developed as well.

**10. Summary Remarks**

**Recommendations for evaluation**

It is recommended that a post-only outcome design within a mature technology department be considered by NIJ. This is particularly important given how little is known about the efficiencies and effectiveness of CEDs from a social science perspective. Alternatively, pre- post- outcome designs within a police department just beginning CED implementation and use could be implemented, if such a department identified.

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