



FORCE SCIENCE[®] NEWS

Chuck Remsberg
Editor-in-Chief

In This Edition:

I. Electrical weapons & fires: How big is the risk, really?

II. Medical examiners & their blame of CEWs in ARDs

III. Damn near everything you ever wanted to know about CEWs!

IV. From our in-box...

To register for a free, direct-delivery subscription to Force Science[®] News, please visit www.forcescience.org. Articles are sent twice per month via email. For reprint or mass distribution permission, please e-mail: editor@forcescience.org

Electrical weapons & fires: How big is the risk, really?

I. Electrical weapons & fires: How big is the risk, really?

Officers in Texas responding to a 911 call discovered a middle-aged Hispanic sitting in his car outside his house, holding a cigarette lighter as he poured gasoline on himself and threatened to set himself on fire. For months he'd talked of suicide by burning. This day he'd doused his home with fuel and, he said, he'd placed a bomb inside as well.

When he broke off conversation with the cops and started to walk toward the house with the gasoline container and the lighter, one officer tried unsuccessfully to stop him with pepper spray. In turn, the subject tried to splash another with gasoline.

Simultaneously, two officers discharged their CEWs. The instant the probes struck, the suspect's clothing burst into flames. By the time officers got the fire out, he'd been burned over his entire body, except for a small patch of skin on the back of his head.

In a matter of hours, the hospitalized suspect became a statistic in a highly limited casualty category: subjects who've suffered fatal burns from fires caused by conducted electrical weapons.



FORCE SCIENCE[®]
INSTITUTE

For what is believed to be the first time, a research team has put numbers and details to what they say is a “small but real risk” in the realm of CEW deployment.

Over the last 13 years, the team reports, six persons have been killed in CEW-induced fires. Another four suffered major burns but survived. About a dozen more experienced burns largely considered minor but also recovered.

Each of those categories included at least one officer.

In the researchers’ estimation, the risk of dying from a CEW-caused fire is about two (1.9) per million, while the risk of receiving non-fatal major burns is slightly more than one (1.3) per million.

“Any fire of consequence from a CEW is a rarity indeed,” lead researcher Dr. Mark Kroll told Force Science News. “And some common concerns officers have about this danger appear to be overstated.”

Kroll, a biomedical engineering professor and a world-recognized electricity expert with the U. of Minnesota, touched on the findings during a presentation recently at a use-of-force conference sponsored by the Miami-Dade (FL) PD. A full account of the research appears in the peer-reviewed *Journal of Forensic and Legal Medicine*. (Click here for a free abstract of the research. The full report can also be accessed there for a fee.)

FIERY FACTS. To discover and document the few cases, Kroll’s team cast a wide net. Because there’s no official repository of statistics about CEW fires, “we performed an exhaustive search of mass media, legal

databases, private compilations of arrest-related death incidents, indexed professional literature, and autopsy and investigator reports via freedom-of-information letters, along with a survey of more than 500 master TASER instructors, to identify any fires, explosions, and burns from CEW usage,” he says.

Despite this mass canvassing, unreported incidents may still have been missed. But the search did surface the 23 fatal and nonfatal fire victims that the team analyzed. The discovered cases occurred in nine US states, plus Canada, Australia, and the United Kingdom.

Kroll, a member of the scientific advisory board for Axon, the TASER manufacturer, explains that flammable fumes in the right concentration “are easily ignited by the electrical arc in the ‘needle eye’ at the back of a CEW probe.”

Multiple liquids have “explosive capabilities” from this source, he says, including benzene (commonly used for meth production), butane (often used to manufacture hash oil), and isobutene (present in cigarette lighters).

Because the concentration of fumes must be “ideal” for ignition to occur, “many electrical weapon probe deployments do not cause any explosion even in the presence of a given fuel,” Kroll explains.

FUELS & INJURIES. Predominately, gasoline was the fuel source in the cases where fatal or major nonfatal burns resulted from CEW-related fires. Examples:

- A suspect in North Carolina was splashed with gasoline from a portable container

when he rolled his van while fleeing from a traffic stop. When a deputy used a CEW to stop him from escaping on foot, his clothing caught fire, inflicting extensive burns that proved fatal.

- A wrong-way driver on a California interstate locked himself in his vehicle to prevent extraction after he was stopped by a spike strip. When an LEO broke the passenger-door window and fired on him with a CEW, the car's interior "violently erupted in flames," killing the driver on the spot. A "quantity of exposed gasoline" in the car from an earlier arson had "vaporized and exploded with the spark from the CEW."
- When police in England answered a disturbance call, they confronted a suspect "drenched in petrol and holding a lit match." Trying to prevent the man from setting himself afire, an officer TASERed him. The suspect was "instantly engulfed in flames" and died five days later.

Only one case in the serious-fire category involved a different fuel source, Kroll's team found. An officer in Missouri discharged a CEW inside a house where a suicidal suspect had released natural gas. "Immediately," the team reports, "the house exploded into flames with sufficient force to blow down walls and partially collapse the roof." The suspect and one officer died from burns. The officer who fired the probes was burned over more than a third of his body but managed to survive.

Where minor or moderate injuries occurred, the fuel sources were more varied. They included sealed containers with lighter fluid, body spray, spray paint, and refrigerant (used for recreational huffing) inside. "Apparently," Kroll says, "a CEW probe

punctured the container and then ignited the contents. While unexpected and frightening, none of these incidents resulted in more than minor burns.

TRAINING POINTS. In analyzing the handful of CEW fire cases they uncovered, Kroll and his team did reach several conclusions with implications for training and field operations.

- Currently, "much stress is placed on the [flammability] risk of OC spray," Kroll writes. However, the researchers documented several cases in which OC was used in conjunction with a CEW without producing any flames.

OC/pepper spray "often uses flammable propellants such as isopropyl, alcohol, ethanol, and methyl isobutyl ketone," Kroll writes. "Many of the OC sprays that are labeled as 'non-flammable' actually can be ignited by a CEW." Typically, though, only a "small flame" will result, "unlikely to produce a severe burn injury."

Kroll believes "the concern over concomitant usage of a CEW with OC spray may be overstated." In their exhaustive search, his team found "only one instance of a CEW-induced fire involving OC," and the suspect suffered minor burns to his face and neck.

- Another worry Kroll considers "excessive" concerns CEW use around filling stations, where "officers appear to be reluctant to use" the weapon for "fear of igniting gasoline."

In his opinion, they "should not be afraid to use a CEW at a service station as long as they or the subject are not standing next to a car

being fueled or the gas pump.” However, he does not specify the exact distance he considers safe from vapor ignition.

Of course, deployment of a CEW on someone drenched in gasoline—or any other potentially flammable liquid—“should be avoided, which is already a standard caution,” Kroll says.

- Special warnings and training regarding flammability are not warranted, Kroll believes. “The existing warnings of the largest CEW manufacturer [Axon] appear to be consistent” with his team’s findings, he writes. “They warn against usage around ‘explosive or flammable clothing or materials, liquids, fumes, gases, or vapors,’ including gasoline, vapor or gas found in sewer lines or methamphetamine labs, butane type lighters, flammable hair gels, or some self-defense sprays.

“With hindsight, we could say that strictly following these warnings could have prevented” at least some of the burn-injury cases his team reports, Kroll writes. He concedes, however, that this is “utopian reasoning” that may not always be a practical guideline in desperate control situations where there are many unknowns and where split-second decisions must be made.

Dr. Kroll can be reached at: mark@kroll.name. The colleagues who joined in this research are Mollie Ritter, PA, MS of the Atlanta’s Piedmont Health System, and Dr. Howard Williams of the Texas State U. School of Criminal Justice. Their Journal report is titled: “Fatal and non-fatal burn injuries with electrical weapons and explosive fumes.”

II. Medical examiners & their blame of CEWs in ARDs

Most of Dr. Kroll’s presentation at the use-of-force conference mentioned above dealt with persistent myths about the alleged electrical dangers of CEWs, particularly claims that these control weapons can cause electrocution and fatal heart disruptions.

The world’s most prolific inventor of cardiac-related medical devices, Kroll is renowned as one of the top international authorities on the effects of electricity on the human body.

The targets of his remarks were what he terms “rogue” medical examiners and coroners. These, he said, are pathology practitioners who, because of limited training, inexperience, anti-police bias, pressure to be conclusive, and/or a profound misunderstanding of how electricity works, identify CEWs as the culprits in arrest-related fatalities where no other cause of death is readily apparent.

ELECTRICITY 101. Kroll disputed some assertions that shocks from a CEW have been fatal by explaining some relevant fundamentals about electricity.

First, he compared CEWs to a common and essentially benign source of shock: electric fences. Under prevailing safety standards, an electric fence can deliver up to 8 watts of short-pulse electricity when touched, likely resulting in some pain or discomfort but far from being lethal. In contrast, the TASER X26E delivers only 1.9 watts, “not even close” to the allowed output of an electric fence, Kroll said.

Similarly, the X26 discharges the equivalent of 13 milliamperes (mA) of household AC current. By international safety standards, Kroll said, up to 35 mA is considered safe for humans and the threshold for seriously dangerous consequences is considered to be above 100 mA.

“Electricity is not like poison,” Kroll stressed. “It does not ‘build up’ in the human body by extended or repeated exposure, and it does not combine with other stressors to produce an enhanced effect. So a cumulative number of seconds of CEW exposure does not increase the risk of serious injury or death.

“If an electrical current is strong enough to electrocute it will do so in and of itself in one to five seconds,” he said. “Prolonged delivery of weaker currents has essentially no effect. The number of trigger pulls of a CEW may seem alarming to a judge or jury that doesn’t understand electricity but scientifically it’s irrelevant in terms of life-threatening danger.”

Research suggests that the greatest risk of fatal results from a CEW would be if a probe were to penetrate to within one-eighth of an inch of the heart or to actually touch that vital organ. “Dart-to-heart distance is critical,” Kroll said. “Theoretically, proximity closer than about three millimeters could induce ventricular fibrillation and cause death, but that hasn’t happened yet, after more than 3,000,000 TASER exposures. And according to scientific studies, that depth of penetration is highly unlikely with any subject weighing more than 56 pounds.”

Yet in some cases medical examiners have claimed that CEW shock caused a fatal heart disruption where probes struck far away from the heart (including only to the back) or

where there had been no probe penetration at all, Kroll charged.

COUNTER-TACTICS. Kroll recommends that police authorities try to establish dialog about the realities of non-shooting ARDs with their local medical examiner. “Offer to forward scientific papers about these deaths, if the pathologist is open to it,” he suggests.

If the ME seems disinterested or uninformed, it may be wise to have an alternative, independent pathologist lined up to supplement his or her findings in the event of a controversial fatality.

“Arrest-related death is a well-recognized syndrome, often with no single pathological mechanism that can be identified as a cause of death,” Kroll said. “Medical examiners need to understand that some fatalities simply cannot be explained. Better to acknowledge that in official rulings than to erroneously blame a valuable and overwhelmingly safe police weapon that scientifically could not have been the cause.”

Additional reports from the Miami-Dade PD’s use-of-force conference will be carried in future editions of Force Science News.

III. Damn near everything you ever wanted to know about CEWs!

A remarkable, up-to-the-minute compendium of information about conducted electrical weapons can be accessed free of charge, thanks to the efforts of Atty. Michael Brave.

Brave, Director of CEW Legal for Axon Enterprise, Inc., (formerly TASER), is well known in law enforcement training circles

for his file-cabinet memory of research studies, court cases, and other valuable resources related to CEWs.

His unique compilation, comprised of hundreds of documents, includes everything from the risk of infection from CEWs and the impact on memory from being exposed to a CEW to the proper tactics for dealing with excited delirium syndrome and the often-overlooked subtleties of arrest-related deaths.

His last-minute additions include excerpts from the just-published new book, *Guidelines for Investigating Officer-Involved Shootings, Arrest-Related Deaths, and Deaths in Custody*, edited by Drs. Darrell Ross and Gary Vilke, which Force Science News will be reviewing in a forthcoming issue.

Whether you're a trainer, a police attorney, an administrator, or a line officer, it's likely that any question you have regarding CEWs and related issues can be answered here. Click [here](http://www.ecdlaw.info/1.pdf) or visit www.ecdlaw.info/1.pdf, scan the Table of Contents, and be prepared

to be fascinated by how much you can learn even by casual browsing.

Michael Brave can be reached at: Brave@laaw.com.

IV. From our in-box...

In response to our recent two-part series on a police attorney's defense of an officer charged with manslaughter after a controversial shooting in Oklahoma:

I am always looking for ways to educate people on the reality of why the police do what we do. It's often an uphill battle, especially in a liberal venue. Your reports on an officer's defense in a high-profile shooting is an excellent case study that I can share during my conversations.

Sgt. Dean Halley
Dept. of Public Safety
Portland (OR) Community College

Written by Force Science Institute
2017

Visit www.forcescience.org for more information

Reprints allowed by request. For reprint clearance, please e-mail: editor@forcescience.org. To unsubscribe from these mailings, please send your request to editor@forcescience.org and you will be removed promptly.