

PSDB Further Evaluation of Taser Devices

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Publication No 19/05

POLICE SCIENTIFIC DEVELOPMENT BRANCH

PSDB FURTHER EVALUATION OF TASER DEVICES

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FIRST PUBLISHED 2005

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Published by:

Home Office
Police Scientific Development Branch
Sandridge,
St Albans
Hertfordshire AL4 9HQ
United Kingdom

COVER PHOTOGRAPH
By Mark Famy

Management Summary

PSDB has been tasked, by the Home Office, the Association of Chief Police Officers (ACPO) and the Northern Ireland Office (NIO), with carrying out an evaluation of less lethal technologies. Along with these organisations, Her Majesty's Inspectorate of Constabulary (HMIC), PSDB, the Policing Board of Northern Ireland and the Ministry of Defence (latterly through the Defence Science and Technology Laboratory) formed a Steering Group to guide this evaluation.

The ACPO Working Groups on Police Use of Firearms, Self Defence and Restraint and Public Order produced a joint Operational Requirement (OR) for a less lethal tactical option. PSDB's evaluations have been directed at providing a complete and accurate scientific and technical response to that requirement.

Taser devices were extensively examined by PSDB and a report, PSDB Evaluation of Taser Devices¹, was published in July 2002. As a result of that report and the medical statement provided by the DSAC* Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL)² ACPO decided to go ahead with an operational trial in five forces in the UK using the Taser International M26 Advanced Taser with the support of Home Office ministers. Some areas for further testing of the M26 had been highlighted in the DOMILL statement and a new taser, the Taser International Taser X26, had become available. The ACPO Working Group on Police Use of Firearms asked for this new taser to be evaluated by PSDB. This report contains the following new information:

- ☐ The laser in the sighting system has been classified as 3R according to the British laser safety standard BS EN 60825-1. Although this class exceeds the internationally agreed maximum permissible exposure (MPE) values (1mW), because of the safety factors in MPE values, they are unlikely to cause eye injuries for accidental exposures but intentional viewing must be avoided. However, the M26 does not currently comply with the standard's labelling requirements.
- ☐ There is a low risk of the taser affecting medical equipment in a dangerous way.
- ☐ Further work commissioned by PSDB, and to be published in the supplement to this report, has indicated that there is no significant risk of affecting the flight-critical systems of aircraft in flight.
- ☐ There is a significant risk of ignition if a taser is fired at a target that has been previously sprayed with either CS or PAVA incapacitant spray. CS spray is more likely than PAVA spray to ignite but PAVA solvent burns with a blue flame that is difficult to see in bright light conditions.
- ☐ The residual medical concerns over the M26 taser raised by DOMILL have been investigated by the Defence Science and Technology Laboratory (Dstl). The information provided was reviewed by DOMILL and contributed to their second statement on the M26, which is included in the appendices of this report. It concludes that the risk of life-threatening or serious injuries from the M26 Taser is very low.

Throughout the testing and the handling trials covered in this report, and when compared to the Operational Requirement, *the X26 taser performs marginally better than the M26 in most areas*. However:

- ☐ The M26 is approximately half the cost of the X26;
- ☐ Of the eleven X26 units supplied to PSDB, discounting the two that were used in drop-testing, seven broke down under no more duress than repeated usage in a 6-month period. These X26 units were early production models and PSDB received 20 replacements and tested them repeatedly over a month-long period. None broke down entirely during the test but two units' pulse repetition rates slowed significantly (thus reducing the power being delivered). This shows an improvement over the previous units but should not be regarded as definitive reliability testing.

* DSAC: Defence Scientific Advisory Council
PSDB 19/05

When the medical implications of the use of the X26 were examined by DOMILL it was concluded that "The risk of a life-threatening event arising from the direct interaction of the currents of the X26 Taser with the heart, is less than the already low risk of such an event from the M26 Advanced Taser." DOMILL also noted that if the X26 is more effective than the M26 in stimulating skeletal muscle, as claimed, then there will be a greater likelihood of head injury after contact with surfaces due to the less controlled fall. However, the risk of serious head injury is still considered to be low.

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1 INTRODUCTION

The following groups have tasked the Police Scientific Development Branch (PSDB) with carrying out an evaluation of less lethal technologies:

- The Home Office Action Against Crime and Disorder Unit (AACDU), now the Public Order and Police Co-operation Unit (POPCU);
- The Association of Chief Police Officers (ACPO), specifically the following working groups under the Conflict Management Portfolio:
 - Self Defence and Restraint (SDAR);
 - Police Use of Firearms (PUoF); and
 - Public Order.
- The Northern Ireland Office (NIO) Patten Action Team.

The above organisations, along with Her Majesty's Inspectorate of Constabulary (HMIC), the Policing Board of Northern Ireland and the Ministry of Defence, including Dstl, are represented on the Steering Group for this project. An Operational Requirement (see Appendix D) was produced for less lethal tactical options in August 2000 by the ACPO PUoF and SDAR working groups, now the Conflict Management Portfolio, and amended in June 2001 to include the requirements relevant to the policing of public disorder, as requested by the ACPO Public Order working group.

Electrical Incapacitation Devices were identified as a priority technology and in July 2002 PSDB published a report on taser devices¹. This report, entitled PSDB Evaluation of Taser Devices, marked the end of an in-depth evaluation and examined the benefits and drawbacks of taser technology as a whole, as well as evaluating the seven taser models that were available at the time. It consisted of in-house testing, handling trials, a review of international information and a comparison of these results with the Operational Requirement.

As a result of PSDB's report and the medical statement provided by DOMILL,² Ministers gave their support to ACPO to proceed with an operational trial in five forces in the UK using the Taser International M26 Advanced Taser (the M26). Some areas for further testing of the M26 had been raised and a new taser, the Taser International Taser X26 (the X26), had become available. The ACPO Working Group on Police Use of Firearms asked for this new taser to be tested by PSDB.

This report encompasses the additional work that was required on the M26 and the evaluation of the X26. It is written as a follow-on to the previous report and thus does not examine tasers in a generic sense. The X26 is examined in direct comparison to the M26 as the unit that has now been approved for operational use in support to firearms in all forces. This report also assumes a previous knowledge of tasers and their associated terminology and should be read in the context of the previous report. It is comprised of seven chapters including this introduction:

- Chapter 2 consists of a description of the X26 and the M26, as well as various Taser International cartridges;
- Chapter 3 details the further testing that was required on the M26;
- Chapter 4 examines the performance of the X26 against a series of in-house tests and provides information on the international use of taser devices, with important statistics on effectiveness ratings and reasons for failure;

- Chapter 5 provides an analysis of taser comparison handling trials that were carried out in February 2004, involving 38 police officers from 12 different police forces. These trials allowed a direct comparison of the differences in handling between the X26 and the M26;
- Chapter 6 focuses on the ACPO Operational Requirement for a less lethal tactical option and examines which of the models best meets each aspect of that requirement; and
- Chapter 7 draws conclusions from the whole report.

In addition to these chapters, Appendix E contains a statement by DOMILL on the residual medical issues raised concerning the M26 and Appendix F a statement regarding the medical implications of the X26.

2 COMPARISON OF TASER MODELS

2.1 Introduction

In June 2003 Taser International acquired all of the assets of Taser Technologies (including Tasertron). All of the Tasertron products examined in the last PSDB evaluation are no longer produced. These include the TE86, TE93, TE95 and TE95HP models as well as the “Patrol Taser” and the prototype HP121.

Since PSDB’s last report, Taser International have produced two new taser devices: the Taser X26 and MX “Animal Taser”. The company also acquired access to Tasertron customer lists and the right to execute pending contracts with the US government. The company has rapidly expanded and is now custom-building a factory. The lawsuit between Taser Technologies and Taser International has ended.

2.2 Taser Models

Taser International produces six models of taser:

- ☐ For civilian use
 - 34000 Series (small 7W taser)
 - M18 (18W advanced taser without laser sights)
 - M18L (18W advanced taser with laser sights)
- ☐ For law enforcement agencies’ use only
 - M26 Advanced Taser (26W taser, currently approved for operational use in support to firearms in UK forces)
 - X26 Taser (6W “shaped pulse” technology)
 - MX Animal Taser (high amperage taser for use on large animals only)

Details of the company and their products can be found on their website at www.taser.com.

All models except for the X26 and MX were evaluated in the previous PSDB report. This report concerns itself with further testing of the M26 and initial testing of the X26. The characteristics and features of these two weapons are shown in Tables 2.1 and 2.2. The costs detailed in these tables are based on prices quoted by the UK supplier and are correct as of June 2004.

Model	M26 Advanced Taser (44000 Series)	
Manufacturer	Taser International	
Cost of Taser	£395 + VAT	
Cost of Cartridge, All types	£15 + VAT each	
Size/Weight	163 · 36 · 150mm. Weighs 510g.	
Power Output	Nominally 26W with a pulse repetition frequency found to be 25-38 pulses/second.	
Ergonomics	This taser is shaped like a firearm but is available in black with a yellow sticker (model #44000 - shown) or in a variety of colours (including yellow, model #44005, as used in some forces) to differentiate it from a conventional firearm. The forefinger is used to activate the trigger.	
One/two shot capability	Single shot capability before reloading but can be used as a close contact 'stun-gun' after the cartridge has been fired or with the cartridge removed.	
Sighting Mechanism	This model has a single, integral laser sight that is intended to show where the top barb will strike. Estimating where the bottom barb will strike is left to the judgement of the user and the rule-of-thumb that for every 7 feet travelled the bottom barb will drop 1 foot. The sight is activated when the taser is armed and is on continuously. The taser also has mechanical 'fin and blade' sights attached.	
Discharge	The taser continues to discharge for 5 seconds after the trigger is depressed. It can be stopped at any time by engaging the safety switch.	
Cartridges	All Taser International cartridges are interchangeable with all Taser International models. The cartridge types can be found in Tables 2.3 and 2.4. Cartridges have a 5-year shelf life.	
Propellant	The propellant used in Taser International cartridges is compressed nitrogen gas. There is no smoke and little smell emitted when these cartridges are discharged.	
Auditing	Each taser has a serial number marked on it. The M26 model also has a dataport that records the date and time of the previous 585 discharges. In addition each cartridge has its own serial number and when it is fired it releases a number of 'AFID' (Anti Felon Identification) tags – small, coloured, paper discs with the serial number of the cartridge on them. This provides an audit trail at the scene of any discharge.	
Accessories	A battery cover is available that will accommodate a second cartridge to facilitate swift reloading. A battery indicator is also included but is only suitable for use with alkaline batteries. A recharger unit has been introduced that allows rechargeable batteries to be charged whilst in the taser battery pack. This costs £49.50 + VAT. The M26 dataport can also be used to fire the taser remotely. A range of holsters is available. A protective suit for use with the blue training cartridges (see Table 2.3) is available for £350 + VAT but Pro-Tect Systems, the UK agent, currently supplies one for free with the first order for 1000 cartridges (of any type).	

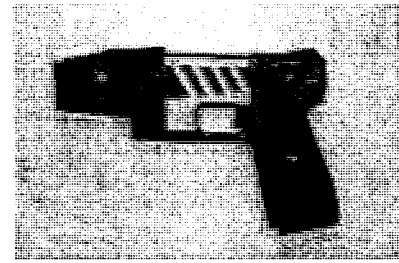


TABLE 2.1 The features of the Taser International M26 Advanced Taser model

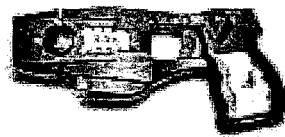
Model	Taser X26 (26000 Series)	
Manufacturer	Taser International	
Cost of Taser	£750 + VAT (including extended warranty)	
Cost of Cartridge, All types	£15 + VAT each	
Size/Weight	150 · 34 · 43mm. Weighs 230g.	
Power Output	Nominally 6W. It discharges with a pulse repetition frequency of 19 pulses/second for the first two seconds, dropping to 15 pulses/second for the subsequent three seconds. If the trigger is held it continues at 15 pulses/second. However, all units produced from July 2004 onwards will stay at 19 pulses/second for the entire discharge. This is also available as an upgrade for older units as a software download. The pulse rate is controlled digitally and so will not change with battery levels or temperature.	
Ergonomics	This taser is shaped like a shortened firearm but is available in yellow to differentiate it from a conventional firearm. The forefinger is used to activate the trigger. It is approximately half the size of the M26.	
One/two shot capability	Single shot capability before reloading but can be used as a close contact ‘stun-gun’ after the cartridge has been fired or with the cartridge removed.	
Sighting Mechanism	This model has a single, integral laser sight that is intended to show where the top barb will strike. Estimating where the bottom barb will strike is left to the judgement of the user and the rule-of-thumb that for every 7 feet travelled the bottom barb will drop 1 foot. The sight is activated when the taser is armed and is on continuously. The taser also has mechanical ‘fin and blade’ sights attached where the fin and blade are yellow.	
Discharge	The taser continues to discharge for 5 seconds after the trigger is depressed. It can be stopped at any time by engaging the safety switch. If the trigger is squeezed again after the discharge has finished but before the countdown (showing “00”) has gone blank then there is a short delay before the weapon discharges.	
Cartridges	All Taser International cartridges are interchangeable with all Taser International models. The cartridge types can be found in Tables 2.3 and 2.4. Cartridges have a 5-year shelf life.	
Propellant	The propellant used in Taser International cartridges is compressed nitrogen gas. There is no smoke and little smell emitted when these cartridges are discharged.	
Auditing	Each taser has a serial number marked on an integrated metal tag. The taser has a dataport that records the time, date, duration, temperature and battery status of the last 2000 firings. It is interrogated via a USB connection and the downloaded files are encrypted. The dataport may lose its data if the battery is left out for more than 24 hours. In addition each cartridge has its own serial number and when it is fired it releases a number of ‘AFID’ (Anti Felon Identification) tags – small, coloured, paper discs with the serial number of the cartridge on them. This provides an audit trail at the scene of any discharge.	
Accessories	A battery is available (XDPM - see Section 2.3) that will accommodate a second cartridge to facilitate swift reloading. An integrated “exoskeleton” ambidextrous holster is supplied with the unit. (See right). A protective suit for use with the blue training cartridges (see Table 2.3) is available for £350 + VAT but Pro-Tect Systems, the UK agent, currently supplies one for free with the first order for 1000 cartridges (of any type).	
		

TABLE 2.2 *The features of the Taser International Taser X26 mode (continued overleaf)*

Additional Features	<i>Central Information Display (CID)</i> When the safety switch is up it shows battery life remaining (0-99%). When triggered it shows a 5-second countdown. When changing the lighting feature (see below) it shows the illumination status. It shows “Re-Arm” status (see below). When the battery magazine is loaded it shows the warranty status: (Expiration) YY, MM (Current system time) YY, MM, DD, HH, MM (System temperature) in °C. <i>Flashlight</i> In addition to the laser sight there is a flashlight feature. The status can be changed using the small, yellow button on top of the unit. The selection is shown on the CID: LF (Laser & Flashlight); LO (Laser Only); OF (Flashlight Only); OO (Nothing). <i>Re-Arm Feature</i> When the taser has been left for 20 minutes in armed mode it switches off and alerts the user to the fact that it needs re-arming by the CID displaying “RA”.

TABLE 2.2 *The features of the Taser International Taser X26 model (continued)*

2.3 Batteries for the Taser X26

The Taser X26 requires a specific type of battery manufactured by the company, that they call a “Digital Power Magazine” or “DPM”. It is a battery made up of lithium energy cells. A benefit of lithium energy cells is that they continue to function at low temperatures (see Section 4.4: Extreme Temperature).

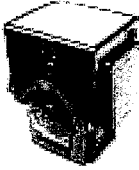
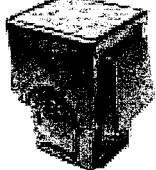
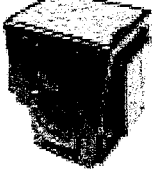
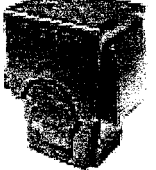
The company claims a battery shelf life of 10 years or up to 300 firings. The DPM also contains a digital memory so that the remaining percentage life of the battery can be displayed on the rear of the weapon. It achieves this by counting the number of times the DPM has been fired within the weapon and calculating the battery life that should be left. It does not record the actual energy level so in fact, there could be more left than the memory is displaying. The company’s recommendation is that the taser should be spark tested before each shift on which it is employed and that the DPM should be replaced when the readout shows less than 20%. The DPM may be used for training with the readout below 20% but above 01%. Use below or at 1% could lead to the unit’s microprocessor resetting or its data being corrupted.

It should be noted that the dataport is also powered by the main battery. The DPM powers the chip and also charges a capacitor. When the DPM is removed the capacitor powers the dataport for 24-48 hours. Once the capacitor is fully discharged the dataport time resets to zero. Therefore, the taser should be stored with a battery inserted.

A battery with a bay for accommodating a second cartridge is available. Called the XDPM (eXtended DPM) it also increases the length of the grip.

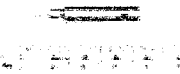
2.4 Comparison of Cartridges

Taser International cartridges can be used in all Taser International taser models. Tables 2.3 and 2.4 compare the features of the different cartridge types for cartridges manufactured since October 2004 and before October 2004 respectively. “Barb” refers to the actual barbed needle at the front of the projectile and “shaft” refers to the metal cylinder that connects the barb to the wire. Prices are as quoted by the UK supplier.

	15ft Regular	21ft Regular [Standard]	25ft XP	21ft LS
Cartridges				
Probes				
Purpose	For sale to the civilian market.	Standard cartridge for sale to law enforcement agencies.	Extra penetration. Longer needles and greater momentum leads to a deeper penetration, e.g. through thicker clothing. Longer range.	Practice cartridge. Used in conjunction with a protective suit the short needles prevent penetration and nylon thread prevents electrical conduction.
Propellant	Compressed nitrogen gas. Taser does not need to be cleaned. The barb shafts are clean.			
Colour	Black with plain yellow blast doors	Black with silver blast doors	Black with green blast doors	Blue with blue blast doors
Shaft dimensions	Aluminium 28.5mm long (including crimping), 5.4mm diameter	Aluminium 28.5mm long (including crimping), 5.4mm diameter	Brass & Aluminium 24.3mm long (including crimping), 5.4mm diameter	Aluminium 28mm long (including crimping), 5.4mm diameter
Barb dimensions	Whole needle: 9.4mm long, 0.8mm wide Barb: 4.0mm long, protruding 0.7mm sideways	Whole needle: 9.4mm long, 0.8mm wide Barb: 4.0mm long, protruding 0.7mm sideways	Whole needle: 13.4mm long, 0.9mm wide Barb: 4.4mm long, protruding 0.6mm sideways	Whole needle: 4.5mm long, 0.7mm wide Barb: 3.2mm long, protruding 0.7mm sideways
Weight	1.6g	1.6g	2.6g	1.6g
Angle of separation	All types, the barbs leave the cartridge at an angle of 8° to each other.			
Velocity*	Muzzle: 50.6ms ⁻¹ At 4m: 29.9ms ⁻¹	0.2m from Muzzle: 48±3ms ⁻¹ At 4m: 25±2ms ⁻¹	0.2m from Muzzle: 43±2ms ⁻¹ At 4m: 26±4ms ⁻¹	Muzzle: 50.6ms ⁻¹ At 4m: 29.9ms ⁻¹
Cartridge orientation	Cartridge can be inserted in 2 orientations. It cannot be inserted in such a way that the weapon fails to function.			
Cost	£15 + VAT	£15 + VAT	£16.50 + VAT	£15 + VAT
Audit trail	Each cartridge has a serial number and disperses 30 to 40 small discs with the serial number printed on them when fired (AFID tags).			
Shelf-life	All types 5 years			

* Velocity values for 15ft regular and 21ft LS supplied by Taser International and unverified by PSDB. 21ft Regular [Standard] and 25ft XP values as measured by PSDB using a high-speed camera.

TABLE 2.3 The features of all types of Taser International cartridges manufactured after October 2004

	15ft Regular	21ft Regular (Standard)	21ft XP	21ft LS
Cartridge				
Probes				
Purpose	For sale to the civilian market.	Standard cartridge for sale to law enforcement agencies.	Extra penetration: Longer needles and greater momentum leads to a deeper penetration, e.g. through thicker clothing.	Practice cartridge. Used in conjunction with a protective suit the short needles prevent penetration and nylon thread prevents electrical conduction.
Propellant	Compressed nitrogen gas. Taser does not need to be cleaned. The barb shafts are clean.			
Colour	Black with plain yellow blast doors	Black with striped blast doors	Yellow with striped blast doors	Blue with striped blast doors
Shaft dimensions	(Aluminium) 28.5mm long (including crimping), 5.4mm diameter	(Aluminium) 28.5mm long (including crimping), 5.4mm diameter	(Brass) 24mm long (including crimping), 5.4mm diameter	(Aluminium) 28mm long (including crimping), 5.4mm diameter
Barb dimensions	Whole needle: 9.4mm long, 0.8mm wide Barb: 4.0mm long, protruding 0.7mm sideways	Whole needle: 9.4mm long, 0.8mm wide Barb: 4.0mm long, protruding 0.7mm sideways	Whole needle: 13.3mm long, 0.9mm wide Barb: 4.4mm long, protruding 0.6mm sideways	Whole needle: 4.5mm long, 0.7mm wide Barb: 3.2mm long, protruding 0.7mm sideways
Weight	1.6g	1.6g	4.1g	1.6g
Angle of separation	All types, the barbs leave the cartridge at an angle of 8° to each other.			
Velocity*	Muzzle: 50.6ms ⁻¹ At 4m: 29.9ms ⁻¹	Muzzle: 50.6ms ⁻¹ At 4m: 29.9ms ⁻¹	Muzzle: 30.5ms ⁻¹ At 4m: 23.2ms ⁻¹	Muzzle: 50.6ms ⁻¹ At 4m: 29.9ms ⁻¹
Cartridge orientation	Cartridge can be inserted in 2 orientations. It cannot be inserted in such a way that the weapon fails to function.			
Cost	£15 + VAT	£15 + VAT	£16.50 + VAT	£15 + VAT
Audit trail	Each cartridge has a serial number and disperses 30 to 40 small discs with the serial number printed on them when fired (AFID tags).			
Shelf-life	All types 5 years			

* Velocity values supplied by Taser International and unverified by PSDB
Cartridge pictures courtesy of Taser International Inc

TABLE 2.4 The features of all types of Taser International cartridges manufactured prior to October 2004

2.5 Cartridge Safety Issues

The DSAC Sub-committee on the Medical Implications of Less Lethal Weapons (DOMILL) was approached by PSDB for comment regarding the medical implications of the use of the XP cartridge and the removal of taser barbs.

2.5.1 Medical Implications of the Use of the XP Cartridge

On the subject of XP cartridges DOMILL advised that:

“The needle on the XP cartridge is 4mm longer than that of the “21ft. regular” cartridge. It also has a slightly higher energy. At an overall length of 13.4 mm, the XP needle could result in a defect on the internal aspect of the body wall at some anatomical locations. Bleetman* undertook ultrasonic measurements of the distance between the external body surface and various organs in 25 volunteers in an erect posture. The minimum depth for the left kidney, spleen, anterior and posterior liver, pericardium, anterior and posterior pleura were all less than 13.4 mm. The median depths ranged from 17-31 mm; superficial major blood vessels were not addressed.

“DOMILL does not know whether the XP needle will penetrate the body wall up to its shoulder. If it is assumed it can, there is a risk that the Taser needle could penetrate the outer surface of an organ. The greatest concern expressed was with regard to superficial blood vessels. In this respect, the XP cartridge has greater risks than the regular cartridge needle. The risk of this event is low, because of the small presented area of superficial major blood vessels.”

It should be noted that this statement assumes that the XP needle penetrates the skin for its entire length up to the crimping on the shaft. The XP cartridge was designed to be used against subjects who are wearing thick clothing and if used as such the risk of more serious injury will be reduced.

2.5.2 Removal of Barbs

On the subject of barb removal DOMILL stated that:

“DOMILL advises that needles/barbs should be removed by medical staff, principally because of the requirement for infection control, the potential for additional trauma to the skin and superficial tissues of the subject, and risk of self injury. This is particularly important with regard to the XP cartridge where perforation of the body wall could have occurred. If there is an operational necessity for police officers to remove the needles/barbs, they must be trained in the risks. Needles/barbs in particularly vulnerable areas such as the eyes, should always be removed by medical staff only.”

* Bleetman A, Dyer J (2000). Ultrasound assessment of the vulnerability of the internal organs to stabbing: determining safety standards for stab-resistant armour. Injury; Oct; 31(8), 609-612

3 FURTHER TESTING OF THE M26 ADVANCED TASER

3.1 Scope of Work

In 2002 the DSAC Sub-committee on the Medical Implications of Less Lethal Weapons (DOMILL) produced a document entitled “Statement on the medical implications of the use of the M26 Advanced Taser”.² In this statement there was a recommendation that “The output of the sighting laser of the M26 Taser should be measured, classified according to British Standards and operated to reduce the risk from the ocular hazard.” Section 3.2 addresses the measurement and classification parts of the recommendation. The laser sight on the X26 was not tested. It is a new model but is manufactured to the same specifications.

Prior to the field trial of the Taser International M26 Advanced Taser in five UK police forces, concerns were raised regarding electromagnetic interference of tasers with electrical equipment, particularly on medical equipment in a hospital environment. Section 3.3 seeks to address the question of the compatibility of tasers with specific types of medical equipment which, if they were to malfunction, would lead to serious repercussions.

The solvents used in both CS (MIBK) and PAVA (50%ethanol/50%water) incapacitant sprays are known to be flammable and concerns have been raised about using the sprays alongside tasers. Previous testing¹, in which a 30ml canister of MIBK was sprayed at a mannequin dressed in a cotton sweatshirt, found that a subsequent taser discharge ignited the solvent on 2 out of 7 occasions. It has also been shown that it is possible to ignite the ethanol/water mix used in PAVA by taser discharge. The testing in Section 3.4 sought to investigate this issue in more depth and in a more operationally realistic way.

3.2 Assessment of the Output from Laser Sights on the Taser International M26 Advanced Taser

3.2.1 NRPB Measurements

The National Radiological Protection Board (NRPB) examined nine taser units (5 M26s and 4 M18Ls). The wavelength and power output of the sighting lasers for these units were measured and the results can be found in Appendices A1.1 and A1.2.

The NRPB report makes two main conclusions:

- “Apart from the 1999 unit (M26 serial number P000451), all of the units are about the same wavelength (653-656nm) and radiant power (2.6-3.0mW). Assuming that there are no failure modes in the electronic circuit that could significantly increase the radiant power of the laser beam, all of the newer units would be assigned to laser class 3R and the older unit to laser class 2.”
- “[It is] considered unlikely that the [1999 unit’s] laser diode would have reduced its output significantly over this time and is more likely to represent a different model of laser diode.”

Subsequently Taser International provided assurances that the lasers had always been manufactured to produce the same beam wavelength and power. However, it was also stated that this type of laser is susceptible to having its output diminished by exposure to static electricity and an older defective unit may have been affected by previous taser discharges.

Regarding the matter of “no failure modes”, further testing has been carried out and is covered in Section 3.2.4 of this report.

In conclusion, discounting the older taser where the laser is believed to have suffered damage, the wavelength of the tested lasers varied between 653nm and 656nm with a

mean value of 654nm. Similarly discounting the older taser, the recorded power output of the laser sights with the tasers in their ordinary operational mode varied between 2.6mW and 3.0mW with a mean value of 2.8mW.

3.2.2 Labelling

NRPB also compared the labelling and information supplied with a taser to the requirements of the laser safety standard³. The results of this comparison were passed to Pro-Tect Systems Ltd (the British Agent for Taser International) and as a result the following label (Figure 3.1) was affixed to tasers provided for the ACPO operational trial.

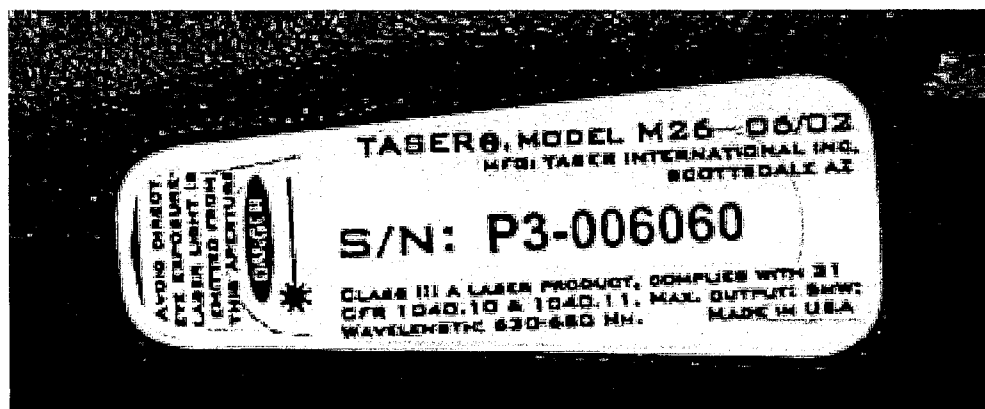


FIGURE 3.1 Example of a label affixed to the M26 Advanced Taser units being used in the ACPO operational trial.

However, this label still *does not fully meet the labelling criteria covering class 3R lasers*. A full comparison of the new label to the criteria can be found in Appendix A1.3

3.2.3 NRPB's General Conclusions

NRPB concluded that “the laser sights on the tasers were generally class 3R laser products. The laser beam from most of these products exceeds the internationally agreed maximum permissible exposure (MPE) values (1mW) but, due to the safety factors in the MPE values, is unlikely to cause eye injuries for accidental exposures. However, intentional viewing should be avoided. The Tasers [also] do not meet the labelling and information requirements of the current British Standard on laser safety.”

However, this conclusion is subject to the caveat that there are no failure modes in the electronic circuit that could significantly increase the radiant power of the laser beam. This was subsequently investigated by PSDB and is covered in Section 3.2.4.

3.2.4 Laser Power Output under Increased Voltage Conditions

In order for the laser to be classified it was necessary to know what the output of the laser would be in any failure modes in the circuit that would increase the voltage to the laser. It was decided that the worst possible failure mode would be a direct short-circuit between the batteries and the laser. Therefore, a catastrophic failure mode of the circuit was tested where the full voltage of the taser batteries was supplied directly to the laser to see what the maximum power output of the laser would be. A full account of the method and results can be found in Appendix A1.4. The peak within the voltage levels of the batteries was 3.77(±0.05)mW and in voltages up to 32V was 4.11(±0.05)mW.

3.2.5 Conclusions

This laser can be classified as 3R according to the British laser safety standard BS EN 60825-1³. This class exceeds the internationally agreed maximum permissible exposure (MPE) values (1mW). Due to the safety factors in MPE values, they are unlikely to cause eye injuries for accidental exposures but intentional viewing should be avoided.

However, in order to conform to this standard the labelling requirements outlined in Appendix A1.3, Table A3 must also be implemented.

3.3 Assessment of the Electromagnetic Compatibility of the Taser International M26 Advanced Taser with Certain Medical Devices

3.3.1 Introduction

Prior to the field trial of the Taser International M26 Advanced Taser in five UK police forces concerns were raised regarding electromagnetic interference of tasers with electrical equipment, particularly on medical equipment in a hospital environment. This report seeks to address the question of the compatibility of tasers with specific types of medical equipment which, if they were to malfunction, could lead to serious repercussions.

The likelihood of electromagnetic interference affecting a piece of equipment depends on how strong the electromagnetic field is and how well screened (immunity level) the equipment is. Electromagnetic field strength is usually measured in volts per metre (Vm^{-1}). The frequency at which the field oscillates is usually measured in oscillations per second, (Hertz – Hz) and can also be important for some pieces of equipment.

Interference effects on unprotected, moderately susceptible equipment are likely to occur at levels above 1Vm^{-1} but particularly sensitive devices could be susceptible at levels as low as 0.1Vm^{-1} . Current standards set immunity levels at 3Vm^{-1} for the majority of medical devices and 10Vm^{-1} for devices providing a life support function^{4,5}. A manufacturer is permitted to produce equipment with a lower immunity if there is a compelling reason to do so but it must carry warning labels and instructions on how to protect it.

3.3.2 Examining Field Strength

3.3.2.1 Medical equipment immunity levels found in previous studies

The Medical Devices Agency (MDA), as part of their report, carried out a literature review and produced the following table (Table 3.1). This table summarises data from those studies where field strengths were measured⁴. It shows the average field strengths required to cause malfunctions with the various equipment categories (not necessarily those that might cause a threat to life during a malfunction, as listed in Section 3.3.3), together with the range between minimum and maximum values.

Equipment	Field Strength* (Vm^{-1}) (lower S.E. – upper S.E. bounds)	Range* – min to max (Vm^{-1})	No. of Cases
Apnoea monitor	0.3 (0.1-0.6)	0.05-12.7	6
ECG monitor	1.9 (1.2-3.0)	0.012-19.3	14
Defibrillator	2.8 (1.0-7.7)	1.6-4.72	3
Incubator	4.4 (1.3-14.9)	0.2-94	2
Ventilator	5.0 (1.8-13.7)	0.9-24.1	3
Pulse oximeter	6.0 (3.1-11.5)	1.6-45.6	7
Infusion devices	14.7 (9.6-22.4)	9.8-86	17

TABLE 3.1 *Threshold electric field strengths to cause equipment malfunction across a number of studies. S.E. stands for Standard Error and represents the range of likely uncertainty about the value of the mean. (Equipment functions are detailed in the glossary).*

The data gathered by the MDA did not differentiate between the frequencies of the signals that were used or even the methodology employed to obtain them. Furthermore, many of the studies did not report tests where the devices were unaffected and so the mean values may be artificially low. Despite this, the table acts a useful indicator as to the order of field strengths that may cause problems. It can be seen that some equipment falls below the 3Vm^{-1} and 10Vm^{-1} limits set out in Section 3.3.1 of this report. Clearly, it would be useful to know what strength of field a taser generates and Section 3.3.2.2 examines a test carried out by Radiometrics Midwest Corporation, which provides this information.

3.3.2.2 Previous measurement of the electromagnetic field generated by the M26 Advanced Taser

In November 2001 an electromagnetic compatibility test was carried out by Radiometrics Midwest Corporation (RMC) on two Taser International M26 Advanced Tasers⁶. This test was conducted at the request of a major airline and so the results were measured against compatibility with equipment which would be found on board aircraft. RMC has been accredited by the American Association for Laboratory Accreditation as conforming to ISO/IEC 17025: 1999 “General requirements for the competence of testing and calibration laboratories”.

RMC tested the tasers in three different modes:

- ☐ taser armed, safety off and no cartridge;
- ☐ operating in drive-stun mode (discharging without a cartridge); and

* The large difference between the range and S.E. bounds is explained in the MDA report: “Because of the huge scatter of the data, means and standard errors were worked out for log transformed values, and the results detransformed for this table. The standard errors are based on the residuals from an analysis of variance.”

- discharging with a cartridge, wires fully extended and a 1000 ohm resistance between the barbs. The measurements were taken 1 metre from the device over a frequency range of 2MHz – 6GHz.

The results in the report showed that the largest electromagnetic field was produced when the taser was discharging through a cartridge, wires and load (many times higher than when there is no cartridge). Therefore, minor quality variations in the production of the unit itself are unlikely to be significant. The peak field produced over all frequencies was approximately 75 dB μ V/m. The conversion to Vm⁻¹ is achieved via the following equation:

$$V = 10^{((d/20)-6)}$$

where V is the field strength in Vm⁻¹ and d the strength of the same field in dB μ V/m. Therefore the largest field produced was approximately 0.006Vm⁻¹ at 1m from the taser. This is clearly far below the 0.1Vm⁻¹ susceptibility level for “particularly sensitive devices” as quoted in the Medical Devices Agency report⁴. It is also below the minimum immunity levels found in Table 3.1. However, it should be emphasised that this is at a 1m distance from the taser.

3.3.3 Equipment Tests – Equipment Selection

Under current guidelines tasers would only be used in a situation where there was a serious threat to life. It was only deemed necessary to test the taser against equipment that could injure someone in the event of a malfunction. After consultation with experts in the field (see Acknowledgements) equipment categories that might cause serious injury or death in a malfunction were decided to be:

- syringe pumps
- volumetric pumps
- ventilators
- automatic external defibrillators
- ECG monitors
- dialysis machines
- external pacemakers

The view from the experts approached was that external pacemakers are particularly sensitive to any electromagnetic field. Testing conducted with the fields from radios and mobile phones has borne this out⁴ and previous testing⁷ has shown that malfunctions have occurred in fields as low in strength as 6Vm⁻¹. However, in most external pacemaker cases, the patients are under constant supervision.

The maximum measured electromagnetic output of the M26 at 1 metre is unlikely to have any effect on the equipment in the other categories. However, for completeness it was decided to ascertain whether there would be a problem at closer distances. The taser was tested in close proximity to an example of each equipment type to observe if there were any effects. This study was small but would have highlighted any serious issues.

The testing took place at the Luton and Dunstable Hospital on Thursday 11th September 2003. A detailed method and the results can be found in Appendix A2.

3.3.4 Conclusions

Activating a taser in proximity to medical equipment will always carry some risk. A lot of equipment in hospitals would be unlikely to cause injury if they malfunctioned. However, those covered in this report carry a higher risk of doing so.

On the evidence presented in this report, it is very unlikely that tasers will have a detrimental effect on any medical devices if activated 1 metre or more away. However, the professional consensus is that external pacemakers can be considerably more susceptible than other medical equipment.

At distances of closer than a metre (again with the exception of external pacemakers, as well as ventilators – in the latter case, due to a lack of evidence) the results of the short test in this report indicate that there is not a major risk of the taser adversely effecting medical equipment.

However, it is recommended that after a taser has been activated all of the following medical devices in use within 5 metres of the discharge be immediately checked for malfunctions:

- ☐ life-supporting devices
- ☐ vital monitoring devices
- ☐ syringe/volumetric devices
- ☐ dialysis machines
- ☐ automatic external defibrillators

Furthermore, all other electrical medical equipment within 5 metres should be fully checked before continued or future use.

3.4 Investigation of The Flammability of The Solvents in CS and PAVA Incapacitant Sprays When Used Alongside Tasers

An initial study into this topic appears in the previous PSDB taser report¹. This study was designed to more closely match operational conditions and further clarify the risk of ignition of the solvents when taser is used. Rather than just using the solvents, operational canisters of CS and PAVA were used, and only 10ml was sprayed on each application, closer in volume to a typical operational use. Also, instead of using a mannequin, a large water container was used and kept at a temperature replicating a typical human body. This was then repeatedly dressed in T-shirts half of which were made from 100% cotton and the other half from 50% cotton, 50% polyester to represent different fabric types used in clothing and allowing for the possibility of different conductive properties. In half of the tests an air gap was incorporated between the taser barb and the “body” to simulate the effect of wearing loose clothing and to introduce a larger spark.

The taser used in this study was the Taser International M26 (as this model has been approved for operational use in support to firearms in UK police forces). However, results gained using the X26 would be unlikely to differ considerably.

3.4.1 Method

The apparatus used is shown in Figure 3.2. The surface of a large water container, approximately the size of a human torso, was brought to skin temperature. Skin temperature was taken as being $33.1 \pm 0.4^\circ\text{C}$ from a sample size of 10 people and the surface temperature of the water container was maintained at $33 \pm 1^\circ\text{C}$. T-shirts were attached to the front of the water container.

An approximate 2-second burst of incapacitant (10ml) was sprayed at the head of the target. The canister was weighed before and after each spray to enable calculation of the exact amount sprayed. The barbs were then attached as shown and a 5-second cycle from the taser was discharged 30 seconds, 2 minutes and 5 minutes after the application of the spray. If the T-shirt ignited no further taser cycles were carried out. A resistor was built into the circuit to replicate resistance from a typical human body.

The test was repeated 40 times with CS and 40 times with PAVA. Of each of these sets of 40, 20 were done without an air gap and 20 with a gap of about 1cm. Half of each set used 100% cotton t-shirts and the other half 50% cotton, 50% polyester. The testing was done in an outdoor shed (to contain the incapacitants) and the temperature and humidity were monitored throughout.

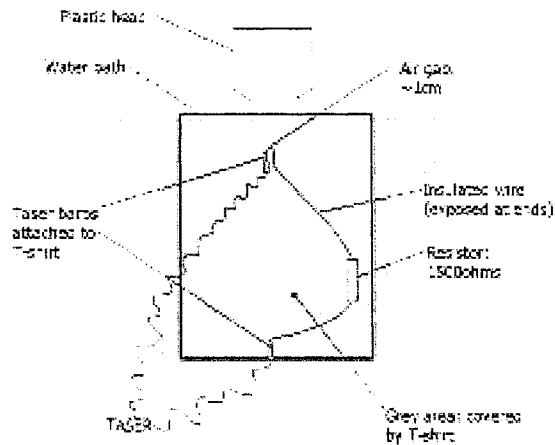


FIGURE 3.2 *Apparatus used to assess the flammability of incapacitants when subjected to a taser discharge*

3.4.2 Results

- ☐ On no occasion did the solvents ignite when there was no air-gap present.
- ☐ When an air-gap was introduced, the CS solvent ignited on 14 out of 20 occasions (7 with each type of T-shirt). All of these were on the first taser application (30 seconds after the spray application).
- ☐ With the air-gap, the PAVA solvent ignited on 6 of the 20 occasions (twice with 100% cotton, 4 times with 50% cotton, 50% polyester). On four of these occasions it ignited on the first taser application (30 seconds after spraying) and the other two were on the second application (2 minutes after spraying).
- ☐ Results for all sprayings can be seen in Appendix A3.
- ☐ The temperature and humidity in the test shed ranged from 6 to 10°C and 58 to 74% respectively. Testing was in an unheated building in winter but the results were not greatly different from previous testing that took place at temperatures around 20°C.

3.4.3 Conclusions

These tests show that there is a significant risk of ignition if a taser is fired at a target that has been previously sprayed with either incapacitant.

As there are several factors in operational scenarios, including temperature and wind conditions, that could affect the likelihood of ignition, it is felt that the results of this study should not be used to predict the absolute probability of either incapacitant igniting. Rather it would be better to conclude that CS spray is about twice as likely as PAVA spray to ignite. The risk is lowest if there is no clothing, or tight clothing, due to the lack of an air-gap. The results with an introduced air-gap can also be used to represent use of the taser in “drive-stun” mode.

It is important to note that although the solvent in PAVA is less likely to ignite, when it does, it burns with a blue flame that is very difficult to see in daylight. Hence, it may not be until the clothing catches fire that the burning would be noticed. This is especially significant if the subject is under the influence of a taser as they would be unable to alert the officer to their predicament.

4 PSDB TESTING OF THE TASER X26

4.1 Introduction

This chapter covers PSDB's in-house testing of the Taser International Taser X26. All tests were carried out to compare the X26's properties with the police operational requirement (see Chapter 6). No tests were carried out that are generic for all tasers as these were covered in the previous report.

4.2 Accuracy

4.2.1 Description

When a taser is discharged at a target a large separation of the barbs is desirable in order to provide maximum incapacitation. However, it is also important that both barbs penetrate the target's skin or at least attach onto their clothing, otherwise the circuit cannot be completed and the electricity will not flow through the target. A number of basic accuracy tests were therefore carried out to determine the maximum accuracy possible for the X26 taser in comparison to the previous testing on the M26 taser.

Like the M26 model, the X26 employs a single laser sight that is designed to show where the top barb will land on the target. During testing the top barb was always referenced to the top laser dot. The full method employed and all of the results can be found in Appendix B1. The taser was tested with both standard and XP cartridges.

The XP cartridge was also tested in the M26.

4.2.2 Summary

The accuracy of the X26 was comparable with that of the M26. However, it was noticeable that, while the top barb struck the target in the vicinity of the laser sight, the bottom barb struck the target to the left of where the top barb struck. This was noticeable for both types of cartridge and, to a certain extent, in the handling trials as well. The shift became more pronounced at greater ranges but generally the barb did not leave the area of an average body. In the handling trials the X26 did not have more misses than the M26. Overall accuracy for both units (both barbs hitting the body) was 91%. The X26 had a slightly smaller spread of hits and the top barb fell slightly above the laser sight at close ranges. This meant that the top barb of the X26 struck closer to the aim point at 15ft (4.6m) than the M26.

The XP cartridge in the X26 was accurate at ranges up to 10ft (3.0m), with a small spread for both barbs at all ranges except for the bottom barb at 25ft (7.6m). The top barb started to fall below the point of aim at 15ft (4.6m) and further at 20ft (6.1m) whereas the standard cartridges were still grouped around it at 15ft (4.6m) before falling away at 20ft (6.1m). At 25ft (7.6m) the top barb is significantly below the aim point. These results were all consistent with the results for the XP cartridge in the M26 taser.

At 25ft (7.6m) the bottom barb falls an average of 1.37m below the aim point. Given that the aim point (the laser sight) is at the mid-nipple line, the subject would have to be approximately 1.87m (6'2") in height* to avoid the bottom barb hitting the floor before reaching the target. Even for subjects above this height the bottom barb would be striking around the feet and ankles so, given the spread of shots at this range, the taser would be unlikely to make the two connections needed to be effective. When the range has reduced to 20ft (6.1m) the minimum subject height would be 1.36m (4'6").

* Calculated using the British Male 18-64 data set in the software "PeopleSize 2000 Professional V2.06c"

4.3 Drop Tests

4.3.1 Description

These tests were carried out to determine if the X26 is likely to discharge when dropped and what kind of treatment it could withstand while still remaining in a working condition. It was also carried out to determine whether the taser could be adversely affected whilst appearing fully functional. The test is deliberately extreme to give an indication of the problems that are likely to occur with the device if it is subjected to such harsh treatment. The drop test involved dropping the item under examination from a height of 2m onto a steel plate and observing any damage that occurred. This method was chosen as it is the technique used in the drop tests for CS sprays, as detailed in the PSDB specification⁸. The method used and the results can be found in Appendix B2.

4.3.2 Summary

Tasers are likely to suffer some damage if they are dropped from a height onto a sufficiently hard surface. The degree of damage will depend on the material of the surface, the height and angle from which the unit is dropped.

The X26 survived testing reasonably well except when the unit was dropped in a sideways orientation. In that case the safety switch snapped; this is clearly the weakest point on the device. There was also some minor cracking of the case and the badge on the DPM was always dislodged.

At no point did the X26 discharge upon impact with the ground. The cartridges generally behaved in the same way as during M26 drop testing.

4.4 Extreme Temperature

4.4.1 Description

The aim of these tests was to determine whether the X26 taser and its component parts (taser unit, batteries and cartridge) would function correctly after being subjected to extremes of heat and cold. The tasers were tested after a minimum of 15 hours at a temperature of -20°C or +50°C. Appendix B3 details the method and results from the tests. The method and results for -20°C come from a study by Lt Tapani Hack of the Nordic Police Technical Centre in Finland and are reproduced here with his kind permission. In previous testing the M26 taser had failed to function correctly at both of these temperatures, at +50°C due to a problem in the unit itself and at -20°C due to a problem with its NiMH batteries.

4.4.2 Summary

The X26 taser and its cartridges functioned correctly after being held at +50°C. The sighting lasers were a little diffuse and may not have been as visible in bright light but this returned to normal within half an hour.

At -20°C the X26 taser unit itself failed once out of 10 shots. The software within it was considered a possible cause and was upgraded. Thereafter the unit did not fail in the subsequent 24 shots. It is possible for the probes to jam inside the cartridge. This eventuality becomes far more likely with standard cartridges, occurring in 13 out of 30 shots.

4.5 Electrical Output Measurements

PSDB carried out tests to determine the electrical output of the X26 taser in terms of waveform and thus, voltage, current, pulse-width, energy and power. Measurements were also made to determine how far the charge can jump from the barb to the body across an air gap before losing its effect (as would be the case if a barb did not penetrate the skin of the target but instead attached to their clothing). The main

purpose of these tests was to examine whether the electrical output of the X26 is significantly different to that of the M26 and if so, provide Dstl with information to help them assess its effects on the human body.

4.5.1 Taser electrical waveform measurement

A circuit was set up to measure the peak voltage across, and peak current passing through, the body (this is illustrated in Figure 4.1). The circuit consists of a potential divider connected between the barbs of the taser. Since the resistance of the body can vary, the taser output measurements were obtained for a wide range of resistances. In this experiment the total value of the potential divider ranged from approximately 47 to 4700 ohms, as these were the boundary values used in a similar, previous study by M.N. Robinson et al⁹. Five X26 tasers were tested in this way.

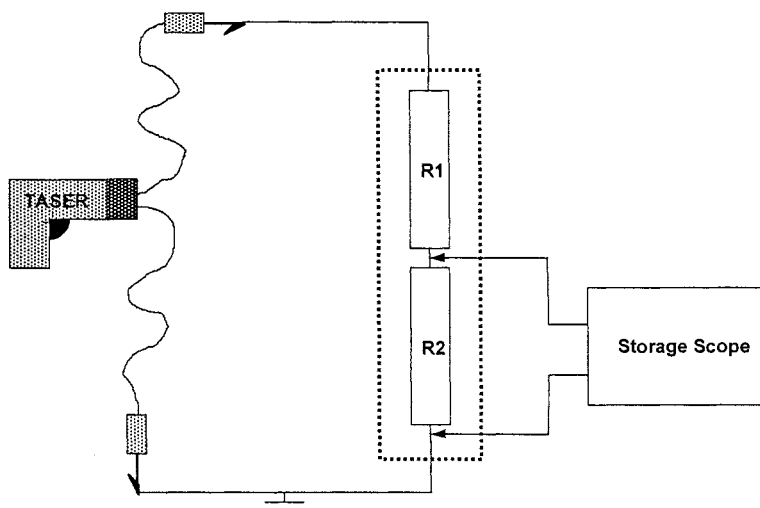


FIGURE 4.1 *Circuit used to measure taser electrical waveforms that are experienced by the body.*

Figure 4.2 shows an example of the wave that is emitted from the X26 taser (the blue line). It is superimposed upon the wave from an M26 taser under the same conditions (the black line). The whole graph represents one pulse of the taser. The first “spike” on the M26 waveform actually goes up to 3000V. It can clearly be seen on this graph that the X26 has a significantly smaller voltage and energy, although the length of the pulse is longer. However, it is claimed that the X26 is more effective than the M26 in stimulating skeletal muscle.

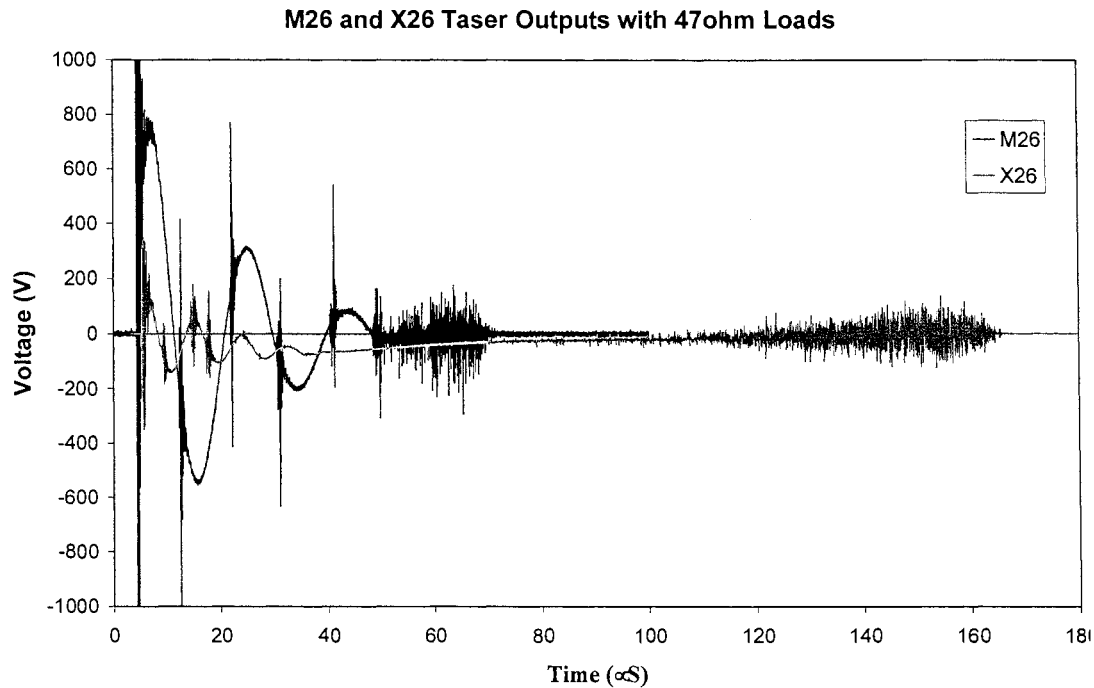


FIGURE 4.2 *Graph of an X26 taser output (blue line) as recorded by the oscilloscope for a resistance of 47Ω , showing variation in voltage over time for one pulse of the taser. The output for an M26 under identical conditions is shown in black.*

4.5.2 Sparking across an air gap

The electricity from a taser can overcome the resistance and jump or “arc” across an air gap that has been introduced into a circuit (as if the barb has attached to clothing and not the skin). This test took as its criterion the distance at which 50% of the pulses from the taser would not arc across the gap. The test was carried out on the same circuit as in Figure 4.1 but without the oscilloscope. The gap was introduced between the upper taser barb and R_1 . The value of the resistance was then varied. Repeat readings were taken every 2mm, the results, including maxima and minima were plotted and then the 50% level was extrapolated.

The results can be seen in Figure 4.3. They are shown alongside the results for the M26. It can be seen that the X26 consistently crosses a slightly larger air gap than the M26. The probable explanation for this is that, despite the overall lower power of the X26, the initial power spike that creates the spark through which the electrical charge flows is greater. The difference between the two tasers is of the order of 5mm. The maximum size of the gap is dictated by the spark gap under test becoming larger than the gap between the electrodes on the front of the taser unit. The spark will then cross the front of the taser unit instead as this is a lower resistance path.

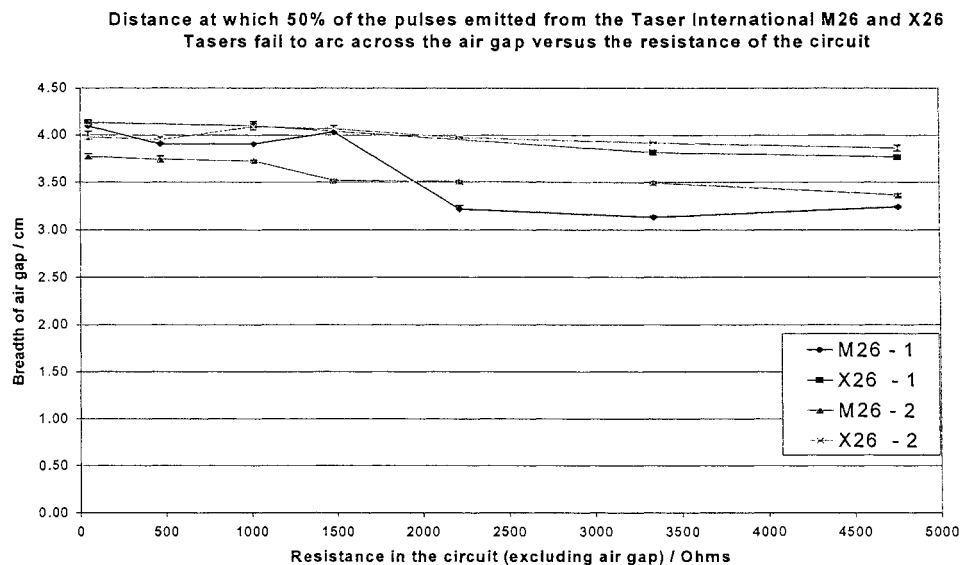


FIGURE 4.3 Graph showing the distance at which 50% of pulses from the M26 and X26 tasers fail to cross the air gap for varying resistance.

4.6

Taser Faults During Testing

Throughout PSDB's evaluation of taser devices, including the handling trials, a number of problems became evident with the tasers. An opportunity arose to draw them to the manufacturer's attention. Their responses, along with the faults, are summarised in Table 4.1:

PSDB Observation/Question	Taser International's Response
The bottom barb fired from the X26 taser moves to the left of where it should strike if it were directly below the top barb.	<i>They did not know why this was. They suggested that it was due to imperfect moulding together of the two halves of the weapon. They are investigating a new system to improve the accuracy of this process.</i>
One wire during accuracy testing was too short to reach the target at 6.1m from the target (approximately 5cm short).	<i>Upon notification Taser International test fired several batches of cartridges and found a small percentage where the wires were too short. They issued formal corrective action to their vendor and have received a documented report of the actions being taken to prevent a recurrence of the problem. Taser International now includes validation of wire length in its daily testing regime and have since not had cause to reject any cartridges.</i>
Air canisters have discharged from fired cartridges and hit targets.	<i>Taser International admits that this will happen on rare occasions. However, they point out that the cartridge will still function as per their specification.</i>

TABLE 4.1 Problems encountered with tasers during testing and Taser International's response (continued overleaf).

PSDB Observation/Question	Taser International's Response
XP cartridges' side buttons were prone to snapping. If it is a problem with the coloured plastic, does this problem extend to coloured tasers?	<i>This is a problem with the fact that they add the colour to the plastic themselves, which makes it more brittle. This applies to all colours except black. In future XP cartridges will be made black with a yellow rear. This problem does extend to coloured tasers, essentially meaning that yellow tasers are more brittle than the PSDB drop-tested black tasers. In the future they intend to purchase "ready made" coloured plastics which will not have this problem.</i>
Blast doors have been seen to embed themselves in targets during testing (often at head height).	<i>They had no previous knowledge of this. They inquired what orientation it was happening in and were informed that it was always a corner of the door. They said that they are currently doing a re-design of the doors and would now think about including rounded corners.</i>
1 out of 5 M26 units failed in the trials.	<i>Taser International has continued a research and development effort for improving the M26 weapon system.</i>
7 out of 11 X26 failed during the trials (not including those in the drop test). Symptoms included: a) 5 second countdown no discharge b) squeaking sound and smell/no discharge c) a pulse repetition rate of 32Hz with no slow down after 2 seconds	<i>They said this could be for any number of reasons Thought this could be a resistance problem at the front of the unit. The circuit is set up to run at this speed and then it is digitally controlled to be slower. If there is a failure in this control system this is what results. It should be noted that if this happens in the field it does not mean that the weapon will be ineffectual.</i>
X26 dataport GMT reading is out by one hour.	<i>The download software has been re-engineered to eliminate clock and compatibility problems.</i>
X26 dataport did not appear to record any firings until it was used for the first time.	<i>They informed us that when a battery (DPM) is inserted in the weapon it charges up a capacitor. When the DPM is removed this capacitor powers the dataport. After 24-48 hours it runs out of charge and the dataport clock resets to 0:00:00 1/1/00.</i>

TABLE 4.1 *Showing problems encountered with tasers during testing and Taser International's response (continued).*

Subsequent to this meeting four more X26 taser units ceased operating.

- ☐ During general demonstrations one ceased functioning in such a way that the taser clicked inside but the spark did not cross the front of the unit. However, it would discharge into a target provided that there was a small enough air gap between the device and the target.
- ☐ Upon removing a taser that had been stored and unused for 2-3 weeks the taser pulsed very slowly without arcing at the front of the weapon and stopped after 2 seconds. When the safety was re-engaged it then cycled through the warranty on the display screen as if the battery had just been inserted.
- ☐ During spark gap testing one unit discharged into its own flashlight. This stopped the flashlight from working and the unit no longer sparked across its front.
- ☐ Also during spark gap testing one unit ceased operating in that it would count down 5 seconds but would not discharge at all.

4.7 Reliability Testing of Further X26 Taser Units

4.7.1 Description

Taser International's overall response to the poor reliability of the X26 was that the models supplied to PSDB were among the first off the production line. Due to the faults they agreed to supply 20 replacement units. PSDB used these in a basic reliability test. This test was not intended as a definitive and rigorous examination of their overall reliability but to identify any persisting problems seen with the units previously tested.

Three different experiments were conducted representing different operational conditions as well as heavy use. The testing took place over the period of a month. All the units were stored with their batteries inserted. During testing the battery life indicator reading was monitored and any malfunctions were noted.

Experiment 1	5 taser units were fired repeatedly (30 times, one after another) at the start of the test period and 30 times again at the end of the test period 4 weeks later.
Experiment 2	5 taser units were fired repeatedly (30 times, one after another) once a week and on the last day of the 4 th week (5 sessions in total).
Experiment 3	10 tasers were fired 15 times every working day (5 at 0900, 5 at 1200 and at 1600).

4.7.2 Results

In experiments 1 and 2 no significant problems were encountered during the test. At the end of experiment 1 of the tasers had been fired 60 times. The battery indicators read 75% on three of the units and 74% on the other 2. At the end of experiment 2 of the tasers had been fired 150 times. The battery indicators read 37% on four of the units and 36% on the other one.

In experiment 3 the tasers were fired a total of 300 times. The results are summarised in Table 4.2. Taser International recommend that the DPM (battery) is not used operationally when it drops below 20% so the number of shots fired (to the nearest 5 shots) before this occurred is shown as well as the number of shots fired before a 00% reading was shown. A 00% reading did not necessarily mean the battery was exhausted but it was always replaced at this point. The replacement DPM was not always new and the percentage life reading of each is shown.

Taser	Initial DPM (battery)			Replacement DPM (battery)			Number of times during the whole test (300 shots) that the taser “stuttered” when triggered
	No. of 5-second shots before 20% displayed battery life remained	No. of 5-second shots before 0% displayed battery life remained	No. of 5-second shots fired when pulse repetition rate significantly slowed (and displayed % life remaining)	Displayed % life remaining of replacement DPM when inserted	Displayed % life remaining of replacement DPM when pulse repetition rate significantly slowed	Displayed % life remaining of replacement DPM at the end of the test	
1	160	195	Did not slow	72	Did not slow	24	1
2	160	190	170 (15%)	96	Did not slow	47	0
3	160	200	190 (4%)	93	Did not slow	47	0
4	160	200	Did not slow	66	Did not slow	19	1
5	160	180	50 (76%)	99	56%	43	5
6	160	205	Did not slow	82	Did not slow	37	1
7	160	205	Did not slow	94	Did not slow	51	0
8	160	195	135 (33%)	92	81%	43	0
9	160	200	Did not slow	99	*	53	0
10	160	200	Did not slow	72	Did not slow	27	2

*The replacement DPM on Taser 9 was replaced after 20 shots as it still displayed 99% battery life remaining and was judged to be faulty. The replacement was at 92%.

TABLE 4.2 *Showing the results of the reliability test – scenario 3*

Four of the taser units’ pulse repetition rates significantly slowed during the test. The numbers of shots and battery life reading are shown for when this occurred. Two of these units slowed *before* the 20% recommended replacement threshold had been reached. Furthermore both of these units slowed again with a replacement DPM inserted. The final column in the table shows the number of times each taser “stuttered”. This occurs when the taser has been used for a while and takes a moment (a few tenths of a second) after the trigger has been pulled to function at the full pulse repetition rate. The manufacturer has reportedly now addressed this problem in all new X26 units. In older units it can be avoided by discharging the taser, though not for a full five seconds, every day.

From this test the units now appear to be more reliable than those initially received by PSDB. However, the two units that slowed during testing suggest that there may still be some problems. It should be emphasised that this was a short, indicative test to look for major problems and not a full reliability trial. PSDB will continue to monitor the performance of all taser models.

5 COMPARISON HANDLING TRIALS

5.1 Handling Trials Overview

5.1.1 Introduction

In February 2004 PSDB held a series of trials to assess the handling characteristics of the Taser International X26 taser device in comparison to the M26 model. A questionnaire was issued to participating officers to establish their views on the tasers used in the trials.

This Section (5.1) describes the organisation of the handling trials including the exercises undertaken and the methods used in measuring officer and taser performance. Section 5.2 summarises the results of the trials and Section 5.3 summarises the responses of officers to the questionnaire.

Each officer attended the trials for one day and was given training in the use of the models of taser being assessed in the trial. Training consisted of an introductory talk followed by a practical introduction to the tasers where officers were given the opportunity to fire one cartridge from both models of taser. After initial training, each officer took part in three or four exercises each of which involved firing 3 cartridges from each model of taser. After completion of the practical stages each officer was given a questionnaire for completion on the day of the trials.

5.1.2 Participating Officers

38 officers from 12 UK police forces participated in the trials; a complete list of participating forces is given in Appendix C1. The forces were chosen from those not taking part in the ACPO operational trial. This was to ensure that the officers would have no prior knowledge of tasers nor any preconceptions or bias between the models. Each force was asked to nominate 3 officers, at least one male and one female, from specified lengths of service (0-5 years, 5-15 years, 15+ years), one of whom was to be a firearms trained officer. Not all forces were able to match these criteria exactly and there were also two extra officers. A breakdown of the attending officers is given in Figures 5.1 and 5.2.

Participants by Firearms Training and Sex

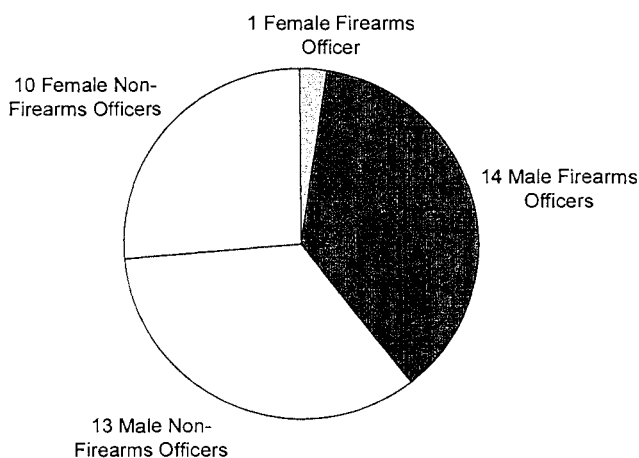


FIGURE 5.1 *Participants by firearms training and sex*

Participants by Length of Service

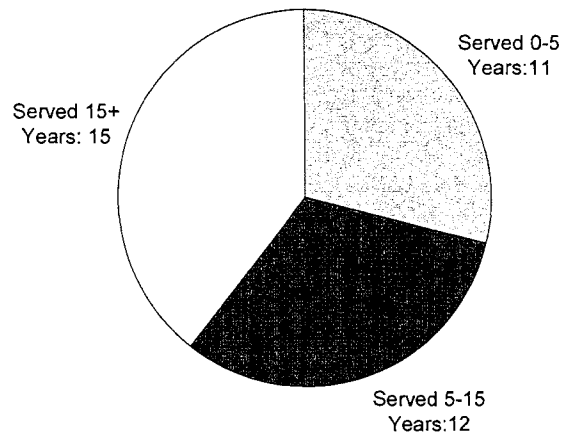


FIGURE 5.2 *Participants by length of service*

The officers each attended one of the trial days that were held at PSDB's facilities at Sandridge in Hertfordshire and Langhurst in Sussex and the Cleveland and Durham Police Tactical Training Centre.

5.1.3

Aim of Trials

The trials aimed to assess which of the two taser models best addressed a number of points raised in the ACPO Operational Requirement for a less lethal device. The seven points addressed are detailed below:

1. **Ease of Operation:** The option should be capable of being operated by one officer. It should be suitable for use by the majority of officers with appropriate training regardless of physical size or gender. It should not rely on complex motor skills.
2. **Environment:** The option should be effective in all operating conditions (e.g. weather, indoors/outdoors, lighting, temperature, etc.) and in confined spaces.
3. **Mobility/Flexibility:** The option should be effective against a moving target. It should be easily transported to the scene of an incident, and ideally portable at the scene.
4. **Repeat Operation - speed of multiple use:** Are repeated applications of the option likely to be required? How feasible is such repetitive operation (by one officer/several?)
5. **Specialist v. General Use:** Is the option appropriate for deployment in all officer roles, or only by specialists (e.g. dog handlers, tactical firearms units, new team)?
6. **Training:** What are the training periods associated with the option's deployment, both initially and in terms of refresher training? What training facilities are required?
7. **Durability:** How robust is the equipment required for an option? Over what period can an option be said to be reliable - what checking is required?

Some of these points were addressed directly in the various handling exercises; others formed part of the questionnaire issued to participating officers. The M26 has been compared to other tasers against these criteria before but in order to carry out a fair comparison to the X26 the participants carried out the tests with both units and no prior knowledge of either.

5.1.4

Exercises

Table 5.1 summarises all the exercises carried out during the handling trials.

Exercise #	Position of Firer	Position of Target	Ambient Light	Status of Taser	Laser Sights Used?	No. of shots	No. of Officers	Extended Grip?
1	Stationary, Upright	Stationary, face on	ON	Loaded, holstered	YES	Single (3)	13	NO
2	Stationary, Kneeling	Stationary, face on	ON	Loaded, drawn	YES	Single (3)	13	YES
3	Stationary, Upright	Stationary, face on	OFF	Loaded, by side	YES	Single (3)	13	YES
4	Stationary, Upright	Moving, face on	ON	Loaded, drawn	YES	Single (3)	13	NO
5	Stationary, Upright	Stationary, face on	ON	Loaded, by side	NO	Single (3)	12	YES
6	Upright, Stationary	Advancing, face on	ON	Loaded, by side	YES	Single (3)	12	NO
7	Stationary, Upright	Stationary, lying on floor	ON	Loaded, by side	YES	Single (3)	12	YES
8	Stationary, Upright, Behind Dummy & aiming over Met Riot Shield	Stationary, face on	ON	Loaded, drawn	YES	Single (3)	12	NO
9	Stationary, Upright	Stationary, face on	ON	Loaded, by side	YES	Multiple (3)	13	YES
10	Stationary, Upright	Stationary, lying on floor	ON	Loaded, by side	NO	Single (3)	13	NO
11	Stationary, Upright, Behind Dummy & aiming around Met Riot Shield	Stationary, face on	ON	Loaded, aimed	YES	Single (3)	13	NO

TABLE 5.1 *Summary of Exercises*

When firing the tasers the officers were instructed to aim at the upper torso with the sight for the upper barb such that both barbs should strike the body of the target. They were told to avoid the head and neck areas when firing. For each shot the position of the two barbs relative to the target were recorded. The position of each barb was recorded by marking on a target outline, as shown in Figure 5.3. For recording the fall of shots on the prone target it was also noted which was the top barb and which the bottom.

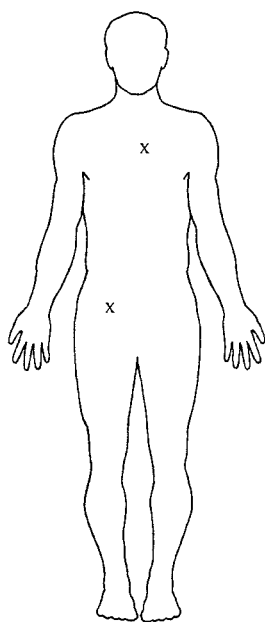


FIGURE 5.3 *Example recording of barb position.*

The targets used were flat, human shaped outlines on cardboard in all of the exercises except shoots 4 and 6 (the moving targets). For these a person in a protective suit was used along with the non-conductive, blue cartridges (see Table 2.3). Blue cartridges were used for approximately 1/3 of shots during exercise 1 to ascertain whether there was a significant difference in accuracy between them and the black (standard) cartridges. No significant difference was noted.

For each shot a record was made of whether both barbs hit the target, both barbs missed the target or one barb missed. A successful shot required both barbs to strike the target. These results are represented in a bar chart as percentages in Figure 5.4 (the percentage in each category is displayed on the relevant bar). Percentages have been used to facilitate the comparison of the results from the different exercises and also to take account of the slightly different numbers of officers attempting each exercise (12 or 13) and the lack of data when occasionally the barbs did not stick to the target.

When both barbs hit the target it was noted whether either of the barbs hit the head/neck area, causing potential injury, or the groin area. When one barb missed the target it was noted if this was wide of the target or between the legs. When both barbs missed the target it was noted if either of these passed between the legs. The distinction was made between a barb passing between the legs or going wide as it is likely that in many real situations this might result in a hit on the legs.

5.2 Results of Comparison Handling Trials

5.2.1 Results based on Exercises

This section summarises the accuracy and time to fire results for each exercise carried out during the handling trials, detailing any apparent trends. The results for the individual exercises can be found in Appendix C2. The number of officers who carried out each exercise was either 12 or 13.

5.2.1.1 Results for stationary targets in normal conditions, with and without use of the sighting laser

“Normal conditions” were considered to be where the officer was upright and stationary, the target was upright and stationary and the exercises were carried out in good lighting. Exercise 1 was carried out in these conditions with the officer using the sighting laser and Exercise 5 without the sighting laser. In both cases the taser was initially by the officer’s side. The accuracy results for each are shown in Table 5.2.

	Target upright, stationary, with sighting laser (Ex. 1)	Target upright, stationary, without sighting laser (Ex. 5)
M26	100% (8% groin)	97% (6% head/neck)
X26	95%	83% (17% head/neck)
N.B. In this table each 2.5% represents approximately 1 shot in the trial.		

TABLE 5.2 *Percentage of shots resulting in both barbs striking the body (also showing percentage of head/neck and groin shots) for Exercises 1 and 5.*

There was little difference in accuracy in Exercise 1 and there was little difference in the mean time taken to fire. However, in Exercise 5 (without the sighting laser) the X26 was less accurate. Also, a larger number of shots struck the head and neck. The mean time taken to fire the M26 (3.7s) was longer than the X26 (2.5s) and so lack of care taken in aiming may account for the drop in accuracy but this may have also been affected by the harder trigger pull on the M26. However, it may be that the M26 is an easier weapon to aim without the benefit of the sighting laser.

5.2.1.2 Results for when the officer was kneeling

Exercise 2 placed the officer into a kneeling position, whilst the target was upright, stationary and in good lighting conditions. The sighting lasers were used. The taser was already drawn and this was reflected in time to fire from the command to do so, being half that for Exercise 1. There was little difference between the models in time taken and virtually no difference in the number where both barbs strike the target (M26=97%, X26=95%, each shot in the trial $\approx$ 2.5%).

5.2.1.3 Use of tasers in low light situations

Exercise 3 was carried out in low light conditions, using an upright, stationary target and using the sighting laser. There was no significant difference between the units in the time taken to fire the taser from the command being given. Furthermore, the time varied little from Exercise 1 (identical exercise but with normal light conditions). The barb position results are the same as in Exercise 1 (M26=100%, X26=95%, each shot $\approx$ 2.5%), suggesting that low lighting makes little difference to the accuracy and that the flashlight on the X26 does not confer an advantage. However, this was not zero lighting conditions, where an M26 user would not be able to see the target at all.

5.2.1.4 Use of tasers against moving targets

Two exercises tested the tasers against moving targets. In Exercise 4 after a random amount of time the target moved from behind a screen into a gap the width of a doorway before moving behind a screen on the other side. The officer had to fire the taser whilst the target was visible. The taser was drawn and ready to use. In Exercise 6 the target started at 9m (30ft) from the officer, out of range of the taser, and then advanced towards the officer. The taser was initially held down at the side of the officer. Firers were asked to judge when the target was in range and had become a threat. The distance between the officer and target when the taser was discharged was recorded. The results are shown in Table 5.3.

	Target moving sideways in a doorway (Ex. 4)	Target advancing towards the officer (Ex. 6)
M26	100% (3% groin)	100% (6% groin)
X26	95% (3% groin, 5% head/neck)	100% (3% Groin)
N.B. In this table each 3% represents approximately 1 shot in the trial.		

TABLE 5.3 *Percentage of shots resulting in both barbs striking the body (also showing percentage of head/neck and groin shots) for Exercises 4 and 6.*

Time taken to fire was not recorded for these exercises, as it was dependent upon the movement of the target. The distance between the officer and the target when the taser was fired is summarised in Table 5.4.

	Distance between officer and target when the taser was fired (m)		
	Minimum	Average	Maximum
M26	1.35	2.97	4.80
X26	2.07	3.43	5.80

TABLE 5.4 *Minimum, mean and maximum distances between the officer and target when the taser was fired for Exercise 6.*

These figures come from a sample size of 37 for each taser; the first standard deviation* is 0.85m for the M26 and 0.79m for the X26. As the difference between the mean values for the two tasers is only 0.46m it is unlikely that this difference is significant.

5.2.1.5 Use of tasers against targets that are lying down, with and without use of the sighting laser

Exercises 7 and 10 involved the officer firing the tasers at human form targets that were lying horizontally on the ground. They were carried out with and without the sighting laser. Initially the officers were given no guidance other than that both barbs should attach to the body and neither should strike the head. If the officer had problems then assistance on how to cant the weapon or where to aim was offered. The results are shown in Table 5.5.

	Target lying down, with sighting laser (Ex. 7)	Target lying down, without sighting laser (Ex. 10)
M26	86% (3% groin, 3% head/neck)	59% (3% groin, 8% head/neck)
X26	89%	63% (3% groin, 8% head/neck)
N.B. In this table each 3% represents approximately 1 shot in the trial.		

TABLE 5.5 *Percentage of shots resulting in both barbs striking the body (also showing percentage of head/neck and groin shots) for Exercises 7 and 10.*

It is clear that use of the sighting laser increased the accuracy for both tasers. The number of head and neck shots, as well as misses can be ascribed to the orientation of the target. It was lying with its head to the right as seen by the officer. The natural motion of the hand (in a right-handed person) is to cant the weapon anticlockwise. This made the laser represent the left taser barb and not all officers realised this. So on several occasions the officer aimed the laser spot at the chest not realising that the "lower" barb would move towards the head. Some officers subsequently compensated by aiming further down the body and some by canting the weapon clockwise.

* The difference from mean value in which 68% of values in a normal distribution would be expected to fall.

There was little difference between the taser models with the X26 being marginally more accurate and causing fewer head and groin shots when used with the laser. The average time to fire was, on average, 0.5s (significantly) faster for the X26 but did not change much between the two exercises.

5.2.1.6 *Reloading the tasers*

In Exercise 9 the officers had to fire the cartridge in the unit, replace with a cartridge from the grip extension and then fire a third, handed to them by the supervisor, as quickly as possible. The officer switched on the safety as soon as it was fired each time as if the shot had missed the target. The position of all the shots and the time taken to complete the task are given in Table 5.6

	Multiple shots into stationary, upright target (Ex. 9)			
	Percentage of shots where both barbs strike body. There were no head or groin impacts	Time taken to fire all three cartridges		
		Minimum	Mean	Maximum
M26	97%	14s	23s	35s
X26	95%	12s	18s	26s
N.B. In this table each 2.5% represents approximately 1 shot in the trial.				

TABLE 5.6 *Percentage of shots resulting in both barbs striking the body and time taken to fire all three cartridges for Exercise 9.*

There was virtually no difference in the accuracy of the tasers. However, reloading and firing the X26 was quicker.

5.2.1.7 *Use of tasers around and over a riot shield*

Exercises 8 and 11 examined the ease of operation of the tasers over the top and around the side of a riot shield, respectively. A full length Met Pattern Riot Shield was set up with a full sized human dummy “holding” it. The officer then had to fire from behind the dummy, whilst exposing no part of themselves beyond the shield except for the hand holding the taser.

	Shooting over a riot shield (Ex. 8)	Shooting around a riot shield (Ex. 11)
M26	94% (3% head/neck)	85%
X26	97% (8% head/neck)	90% (3% groin, 3% head/neck)
N.B. In this table each 3% represents approximately 1 shot in the trial.		

TABLE 5.7 *Percentage of shots resulting in both barbs striking the body (also showing percentage of head/neck and groin shots) for Exercises 8 and 11.*

It can be seen that shooting over the shield was found to be slightly more accurate than shooting around it but did result in a higher proportion of head and neck shots. There was little difference in performance between the tasers in both exercises but again the X26 resulted in a higher proportion of hits in sensitive areas. The tasers were drawn before the command to fire was given so the time taken to fire just gives an indication of how quickly the officer could switch off the safety and take aim when the taser was in an “abnormal” position. The time taken did not vary significantly between the two scenarios but the X26 was fired more quickly, at an average of 1.6 in both scenarios as opposed to 2.7s and 2.4s for the M26.

5.2.2 Comparison of Results from Both Tasers

5.2.2.1 Strike location

The overall barb placements for both taser models were collated from all the exercises and can be seen below in Figure 5.4.

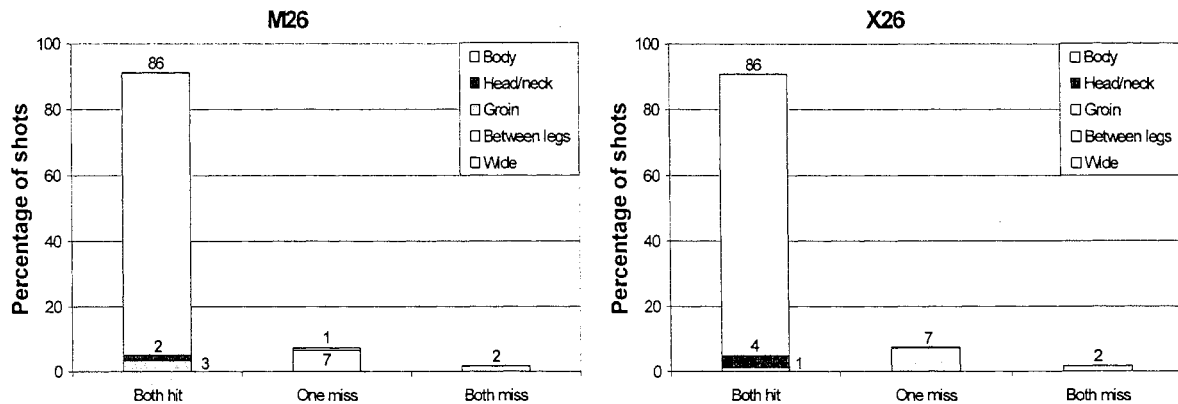
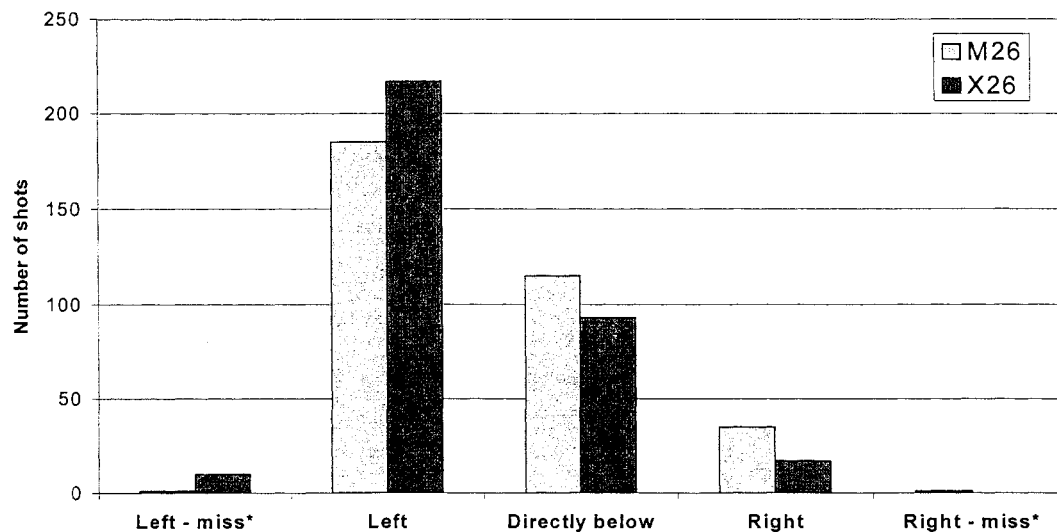


FIGURE 5.4 Overall barb placement (in %) for both taser models from the handling trials. The sample size for each model was 412.

It is clear that when all of the exercises are taken into account there is virtually no difference in the overall accuracy of each weapon.

However, it can be noted that the M26 registered marginally more shots in the groin area and the X26 marginally more shots in the head and neck area. The X26 had already shown a tendency for the lower barb to strike to the left of the upper barb (see Section 4.2). Therefore, if the top barb strikes centrally, the bottom would strike to the left of the groin thus explaining the higher percentage of strikes in this area by the M26. The fall of the bottom barb in comparison to the top barb was examined for all shots and the results are shown below in Figure 5.5. It shows that there is a tendency for bottom barbs from both taser units to be to the left of the top. This could indicate that the way the tasers are held and fired are contributing factors to this situation. However, it is slightly more pronounced for the X26.

Bottom barb distribution in relation to top barb



*miss = missed by virtue of being on that side of the target

FIGURE 5.5 Bottom barb distribution in relation to top barb for all shots with each taser.

Regarding the greater number of head and neck shots from the X26, 9 out of the 15 occurred in the exercises without the use of the sighting laser but 5 out of the 7 with the M26 also occurred in these two scenarios. This shows that it is unlikely to be due to a problem that manifests itself when the sights are not visible and is likely to be a more fundamental issue with the handling characteristics of the weapon.

5.2.2.2 Time taken to fire

The times taken to fire the units from being given the command to do so are summarised in Figure 5.6. The mean time taken is shown for both tasers in each exercise with the error bars indicating the maximum and minimum times achieved by individual officers. Times for Exercises 4 and 6 were not recorded as they depended upon the movement of the target. The longer times in Exercise 9 are due to this being the time for all three shots in the multiple shot scenario. Generally the use of the X26 was marginally faster than the M26 (in all cases except Exercise 1 and Exercise 3). However, this difference was less than 1 second in 6 out of 9 exercises.

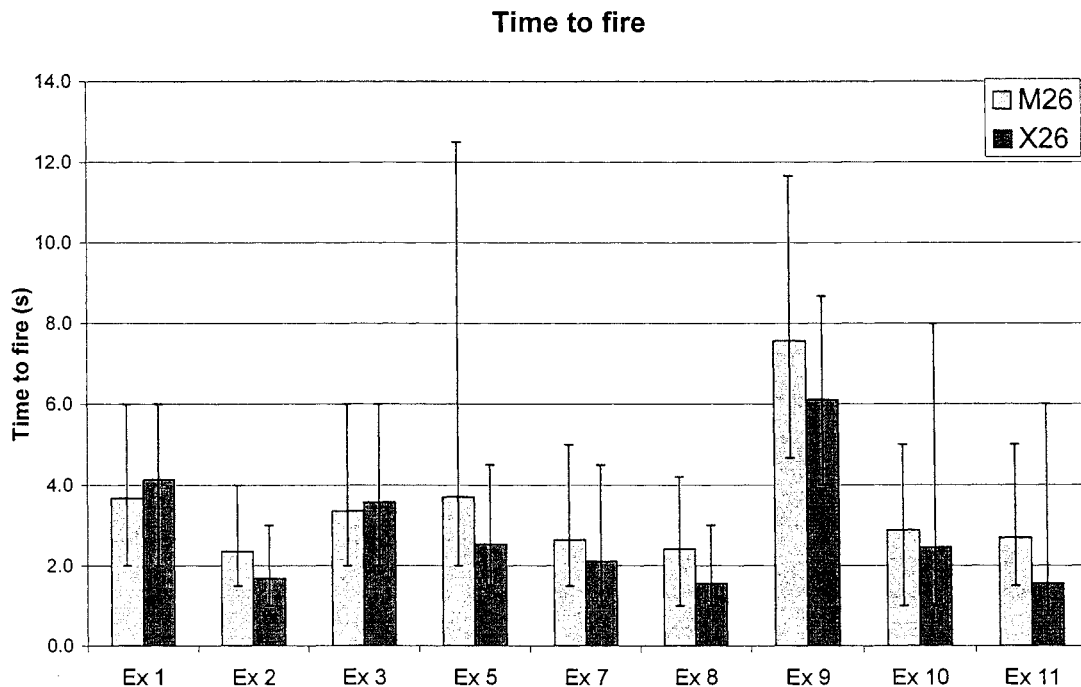


FIGURE 5.6 *Time taken by officers to fire each taser unit from being the command to do so. Showing mean, maximum and minimum times. Exercises where the taser was already drawn were 2, 8 and 11. Ex. 9 is the mean of the total times for 3 shots.*

5.2.3 Conclusions

Over the course of the whole handling trials the two taser models had similar accuracy. Both had the same percentage of barb strike falling into sensitive areas but with the X26 it was more head/neck and with the M26 more groin. The overall percentage of both barbs landing on the body was 91% for both weapons (in the previous handling trials the M26 scored 92%). The X26 was used marginally faster than the M26.

It should also be noted that three officers out of the 38 received a minor shock from the front of the unit. This caused them to pull their hand away quickly. However, In the questionnaires 97% (representing all but one of the officers) agreed with the statement “The device is safe to use without risk of electric shock to the officer”. This could be explained by the fact that two of the officers to receive shocks did so because they

failed to heed warnings given during their training and forgot to switch off the unit during discharge before handling the cartridge. The remaining officer was shocked despite following procedures correctly.

5.3 Responses to Participant Questionnaires

The participants completed a questionnaire after they had been trained in the use of each taser and had taken part in two exercises. The questionnaire consisted of 18 questions.

A statement was given and the participants were asked to indicate whether they strongly agreed, tended to agree, tended to disagree or strongly disagreed with each statement or to indicate a “don’t know” response.

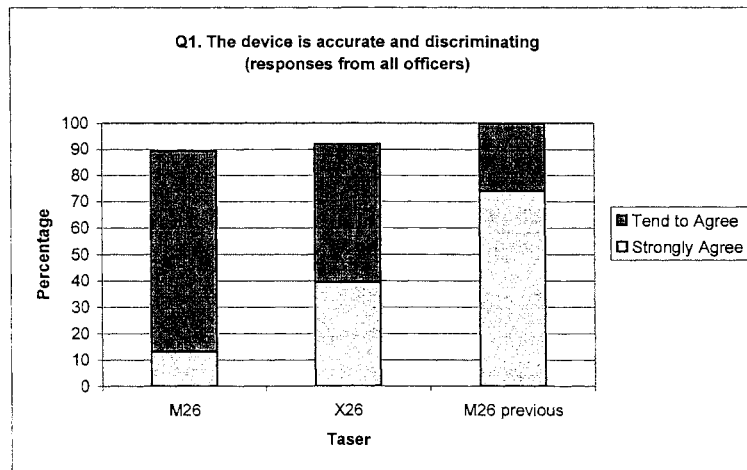
The final two questions asked the participants to select the taser model they liked/disliked most. Space was left for comments to be recorded for each question. A copy of the questionnaire and a full summary of the responses given are included as Appendix C3.

Some of the questions asked in the questionnaire related to specific exercises in the handling trials. As each participating officer did not take part in all the exercises, many officers did not encounter certain situations e.g. moving targets or firing in low light situations. Some officer groups consisted of few officers and it would be difficult to apply any statistical analysis to the questionnaire responses from these groups, however their comments have been included where appropriate.

5.3.1 Responses from All Participating Officers

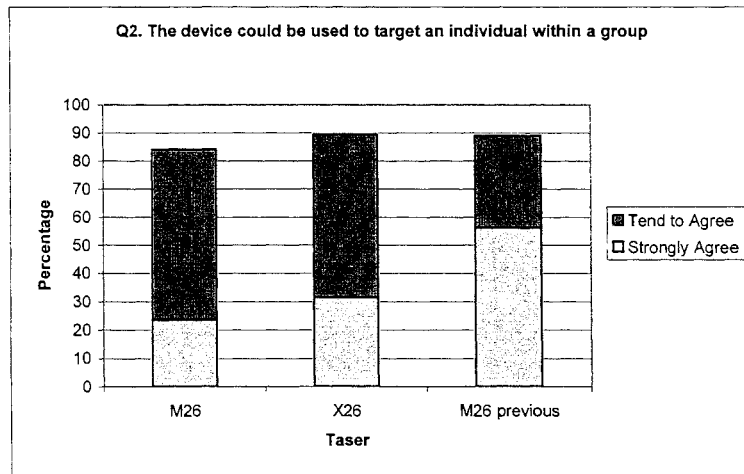
This section collates the results from the 38 officers who participated in the taser handling trials. Each question is discussed individually. The graphs also include the responses given in the 2002 taser handling trials for the M26 model.

Question 1- The device is accurate and discriminating



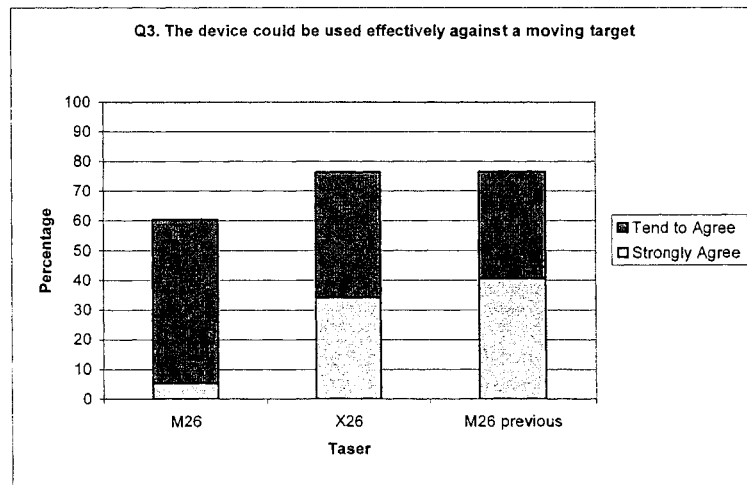
Comments indicated that many officers felt that the M26 was less accurate due to the increased pressure required to activate the device. This was not reflected in the accuracy results.

Question 2 - The device could be used to target an individual within a group



There was general agreement with the statement - provided that the group was small and widely spaced. The requirement for both barbs to hit the target was felt to be a limiting factor, coupled with the potential for movement of the target.

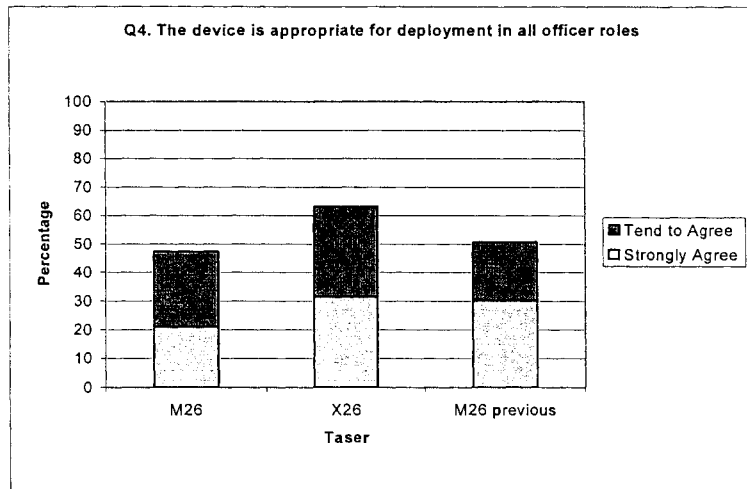
Question 3 - The device could be used effectively against a moving target



The officers involved were generally confident in the use of the tasers against a target moving towards the firer. A number of officers indicated that they would be less confident if the target was moving across their field of vision.

The officers felt that the M26 took longer to activate due to the stiffness of the trigger and safety switch, and that this would hinder the targeting of a moving subject. This was reflected in the slower firing times for the M26 in the exercises.

Question 4 - The device is appropriate for all officer roles

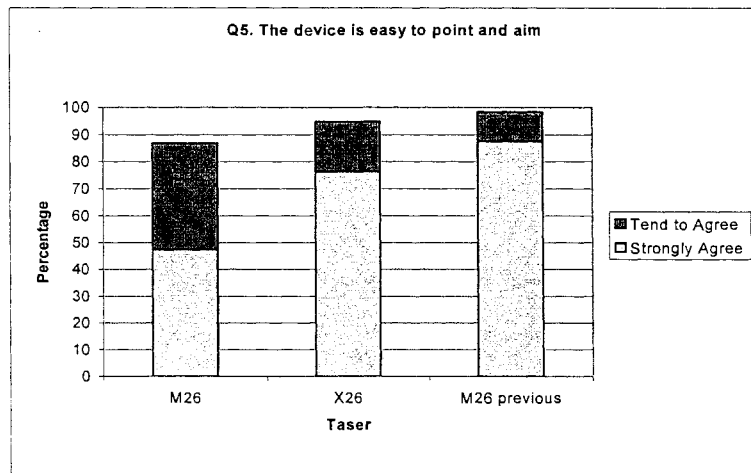


Opinion was roughly equally divided on this issue. Some officers felt that, with the correct training, all officers should have access to the taser – particularly those involved in front line policing. A number of officers compared the taser to use of an incapacitant spray.

Other officers questioned felt that the taser should not be widely issued and that use of taser should be restricted to firearms officers or other specially trained groups.

It was noted that the size of the M26 might make it unsuitable for use in covert situations.

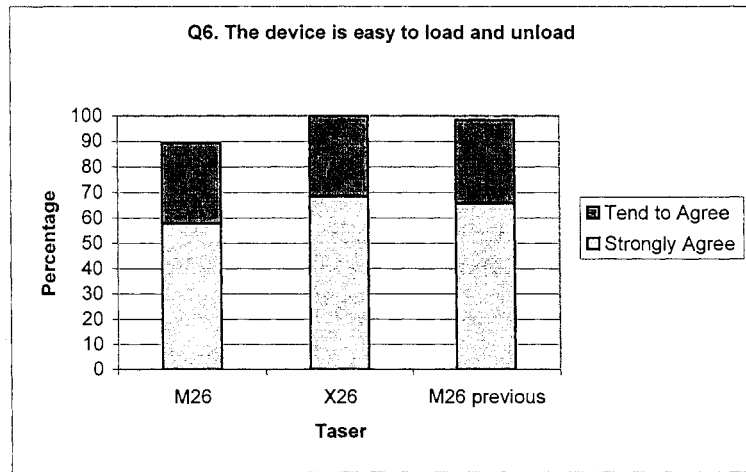
Question 5 - The device is easy to point and aim



Both devices were felt to be easy to point and aim although it was noted the trigger pressure required to fire was greater for the M26.

It was noted by some officers that the X26 had to be tilted slightly to use the non-laser sighting system.

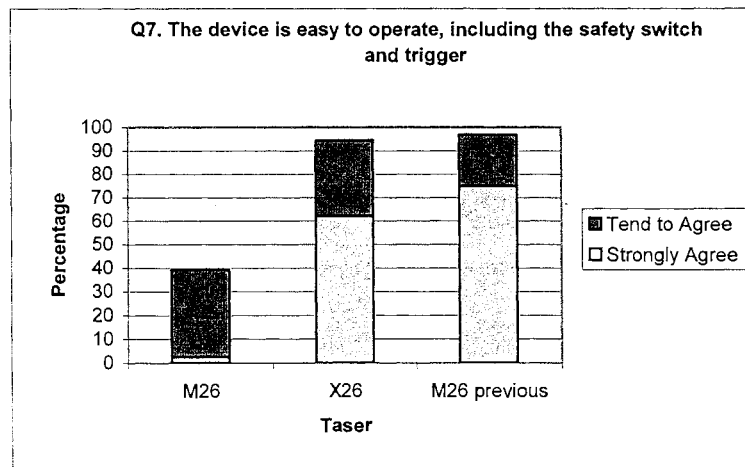
Question 6 - The device is easy to load and unload



Most officers agreed that the tasers were easy to load and unload. The loading mechanisms for each of the devices are identical.

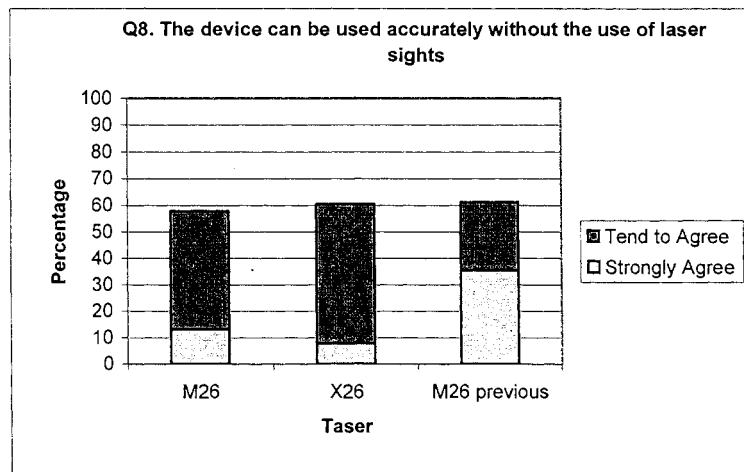
A slight discrepancy is evident in the response as a number of officers commented on the ease of battery loading in response to this question. See Question 16 for further comments on this feature.

Question 7 - The device is easy to operate, including the safety switch and trigger



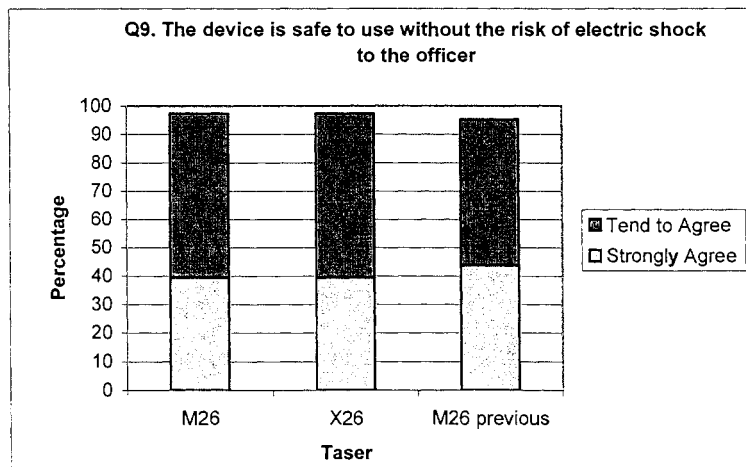
The safety switch and trigger on the M26 were felt by the majority of officers to be stiff and unresponsive, compared to that on the X26. It can be noted that the previous handling trial results show that this opinion is relative to the X26.

Question 8 - The device can be used accurately without the use of laser sights



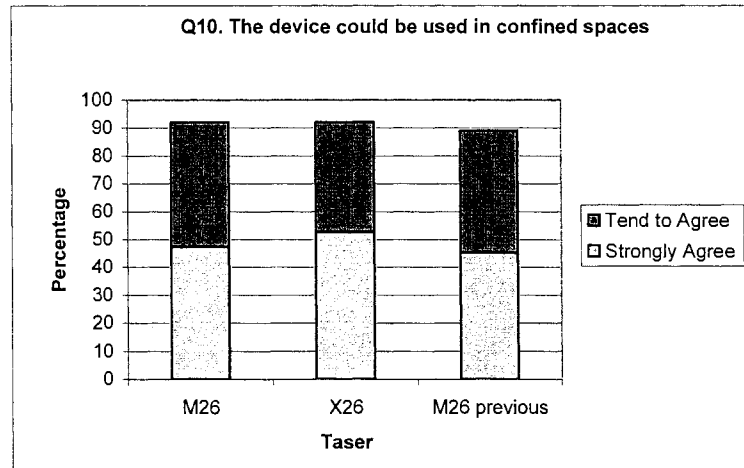
Officers tended to agree that the tasers could be used without the laser sights. However comments indicate that officers feel the tasers would be less accurate and also that time to fire would be increased when laser sights were not used

Question 9 - The device is safe to use without risk of electric shock to the officer



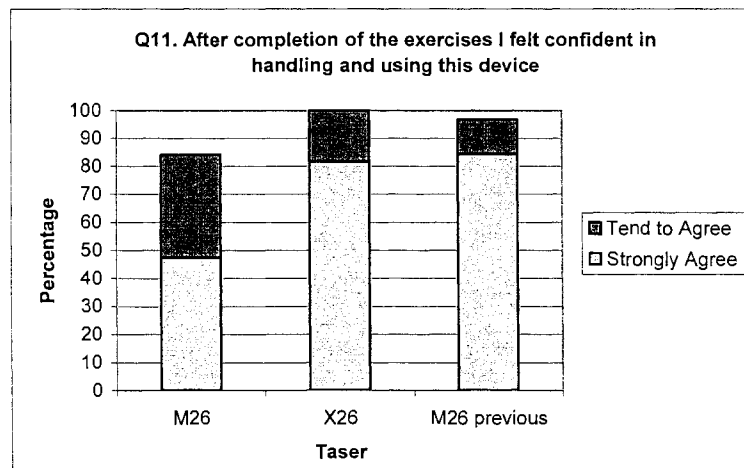
Officers were generally confident that the devices are safe for use by police officers with appropriate training.

Question 10 - The device could be used in confined spaces



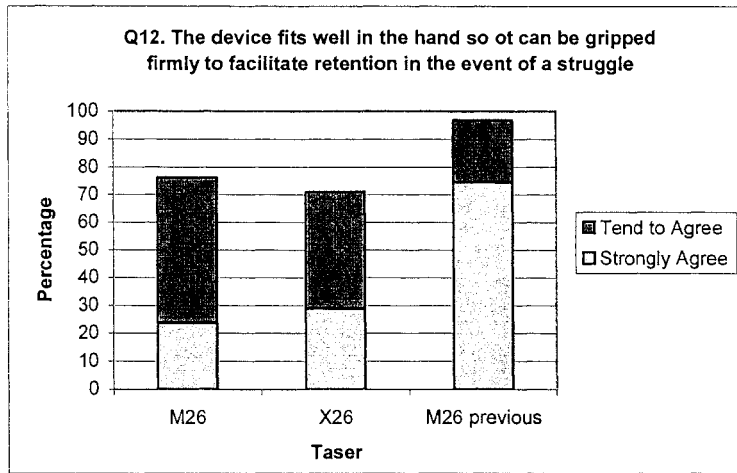
Officers were generally confident that the tasers could be used in a confined space. There were favourable comments pointing out that the effects were likely to be limited to the intended subject rather than experienced by others in the vicinity (as with CS).

Question 11 - After completion of all the exercises I felt confident in handling and using this device



Most officers commented that they were happy with both devices. The comments indicate that the trigger and safety mechanisms on the M26 are more difficult to use than those on the X26.

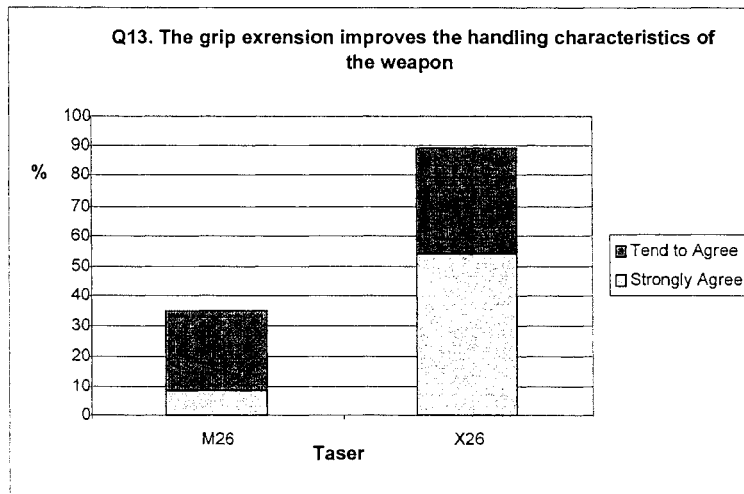
Question 12 - The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle



The officers felt that both devices could be retained in a struggle but that fitting a lanyard attached to the officer's belt might be worthwhile.

Opinion was divided with the small size of the X26 thought by some to be a disadvantage while others thought that it was a comfortable fit for the hand.

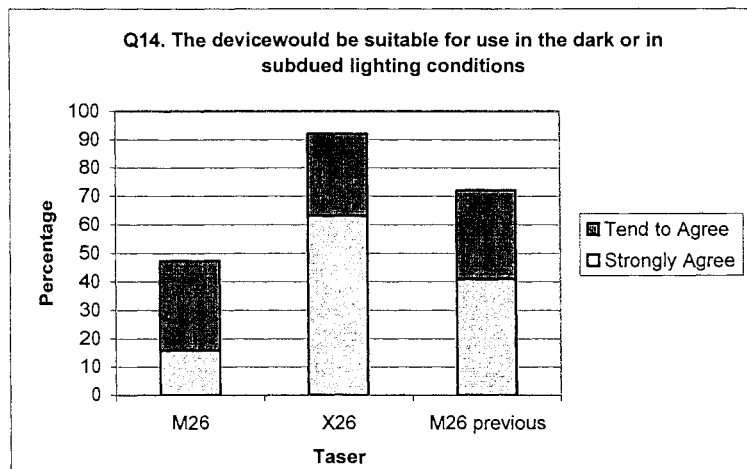
Question 13 - The grip extension improves the handling characteristics of the weapon



The majority of officers felt that the grip extension did not improve the handling characteristics of the M26 – most felt that the grip was large enough (in some cases too large) already.

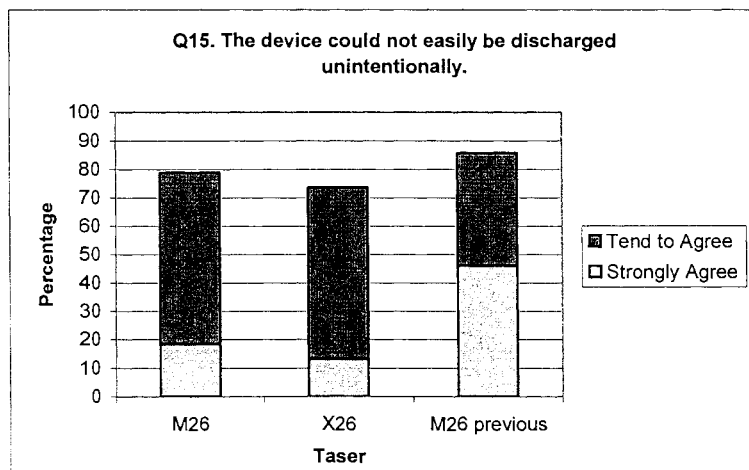
Most officers agreed that the grip extension improved the handling of the X26. Many commented that the extension was essential for handling the device.

Question 14 - The device would be suitable for use in the dark or subdued lighting conditions



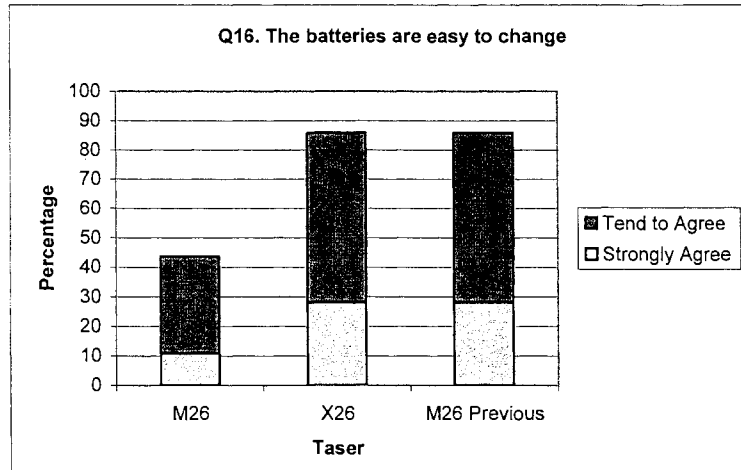
The flashlight feature on the X26 was generally felt to improve the performance of the taser at low light levels although this was not reflected in the results for the low light exercise.

Question 15 - The device could not easily be discharged unintentionally



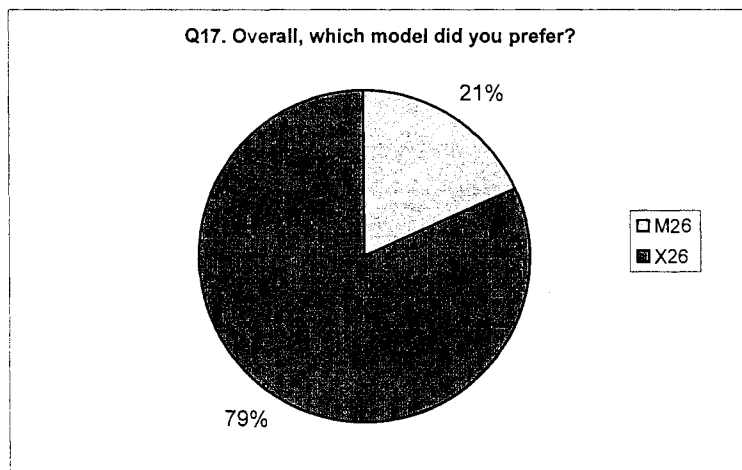
Officers commented that the stiffness of the trigger and safety on the M26 made it less likely to be discharged accidentally.

Question 16 - The batteries are easy to change



Each taser has a very different method of battery replacement. This is reflected in the scores. The procedure is simpler for the X26.

Q17 and Q18 - Overall which model did you prefer and why?



79% of officers participating in the trials selected the X26 as their preferred model. Those officers' reasons included:

- ☐ The ease of activating the trigger and safety switches compared to those on the M26 (over 20 officers commented on this);
- ☐ Lightness of the X26;
- ☐ Ease with which batteries could be changed on the X26;
- ☐ Flashlight feature on the X26;
- ☐ Colour of the additional 'battle sights' (contrasting yellow against black) on the X26; and
- ☐ Digital display indicating battery life on the X26.

Officers who selected the M26 as their preferred model gave the following reasons:

- ☐ Larger size;
- ☐ 'felt more substantial';
- ☐ More likely to be retained in a struggle; and
- ☐ Looks more like a serious weapon.

A number of officers who selected the X26 as their first choice suggested in their comments that they would also be happy to use the M26. Others indicated that they preferred the shape of the M26, but the trigger and safety switches were far easier to use on the X26. A large proportion of officers felt that the handling characteristics of the X26 were improved with the use of the grip extension.

5.3.2 Questionnaire Conclusions

Overall, the X26 is preferred to the M26. In particular the officers noted the new features such as the digital battery indicator and the additional flashlight.

It is important to note that this does not indicate that the officers questioned did not like the M26 – although there was dissatisfaction with the trigger and safety switches on the M26 there was general approval for the design.

5.4 Conclusions and General Comments

The trials were not intended to cover every possible operational scenario in which tasers could be used. Instead the exercises focused on a number of key areas. Furthermore, the exercises were not supposed to be highly realistic but to change the position of the taser in the officers' hands and change the environment they were using the units in.

The training provided at these handling trials was short and a number of issues examined during the trials, such as speed of reloading or aiming without lasers, could be improved with a more extensive training program.

Throughout the trials the two taser units were very similar in accuracy with both recording 91% success of hitting the target with both barbs. The X26 was used marginally faster than the M26. From the responses to the questionnaires 79% of officers preferred the X26 to the M26. However, some of these officers indicated that they would also be happy to use the M26.

6 ADDRESSING THE OPERATIONAL REQUIREMENT FOR A LESS LETHAL OPTION

6.1 Introduction

In August 2000, an Operational Requirement for less lethal tactical options was produced jointly by the ACPO Police Use of Firearms (PUoF) and Self-Defence Arrest and Restraint (SDAR) working groups. In June 2001, this document was amended to include the requirements relevant to the policing of group public disorder, represented by the ACPO Public Order sub-committee. The Requirement is shown in full in Appendix D.

This chapter of the report addresses each point raised in the Operational Requirement based on PSDB's technical and scientific evaluations. PSDB's previous report, "PSDB Evaluation of Taser Devices"¹ addressed the points in terms of taser technology as a whole as well as the taser models that were available at the time. The M26 was identified as the best option by the police to take forward to an operational trial. This section evaluates each point of the OR in terms of a comparison between the M26 and X26 taser models. The information hereafter has been gathered from four main sources:

- ☐ Testing carried out by PSDB on the X26 taser to determine characteristics such as absolute accuracy, performance under ideal and extreme conditions and measurement of the electrical output. Full details and results from this testing can be found in Chapter 4 of this report.
- ☐ Police handling trials carried out in February 2004, with the assistance of 38 police officers from 12 different police forces. These trials involved the officers firing the M26 and X26 models of taser at cardboard, human-sized targets. 11 different exercises were carried out in total, requiring the use of 910 taser cartridges. Each officer also filled in a questionnaire (as seen in Appendix C3), which consisted of 18 different questions and an open comments section. Full details of these trials and the results from the questionnaires are given in Chapter 5 of this report.
- ☐ Information received from the manufacturers, generally relating to the various characteristics of each of the devices. Where possible, this information has been verified or validated.
- ☐ DOMILL statements on the medical implications of the use of M26 and X26 tasers (Appendices E and F, respectively).

Some of the points raised in the Operational Requirement relate to policy considerations or operational aspects that need to be answered either by ACPO and/or Home Office and NIO Policy Units. PSDB will only comment on the scientific and technical aspects of the devices.

6.2 Operational Requirements

This section addresses the first eleven points raised in the Operational Requirement. Each point raised is written in bold text and is enclosed within inverted commas, “ ”. This is then followed by PSDB's response to that point.

6.2.1 Accuracy

“The option should be discriminating over a range between 1 and 25 metres. This range is chosen as an approximation to that within which a firearms containment can reasonably be provided by officers with handguns, accounting for their general accuracy. In public disorder situations accuracy at range will be particularly important since it may be necessary to target individuals within a

tightly packed group. Considerable further benefit will arise if an option is discriminating over a greater distance (e.g. up to 50m), allowing it to be deployed as part of a wider containment, and making it more readily transferable to some public disorder scenarios. Naturally, options that are shown to be effective over only part of this range will still merit consideration.”

The maximum range of both tasers is 21ft (6.4m). This is the maximum length of the wires within the cartridge and cannot be exceeded. 15ft (4.6m) cartridges are also available from the but are not recommended for law enforcement use.

In bench fired accuracy testing it was found that the X26 taser has a slightly smaller spread and that at close ranges the grouping is slightly above the aim point. This means that the top barb of the X26 strikes closer to the aim point at 15ft (4.6m) than the M26. Both weapons are increasingly inaccurate beyond this point. However, the bottom barb of the X26 strikes consistently to the left of where the top barb strikes. When at extreme ranges this becomes so pronounced as to potentially cause a problem.

In the handling trials questionnaires the officers felt that the M26 model was marginally less accurate and discriminating mainly due to the increased pressure required to depress the trigger. However, both models were found to be of equal accuracy overall. 91% of shots resulted in both barbs hitting the body of the target (including the head, neck or groin region) when fired at 13ft (4.0m) from the target.

Both models use a projected single laser sight to aid with the accurate placement of the barbs, showing where the top barb will land on the target. Both the M26 and X26 also have mechanical ‘fin and blade’ sights, with the latter’s being picked out in yellow. However, in handling trials without use of the laser sight (thus using the blade and fin sights) the X26 was less accurate.

Taser units need both barbs to attach to a target to cause incapacitation (it does not matter where they strike). This could be said to be the most important measure of accuracy for tasers. In this respect there is virtually no difference between the units.

6.2.2 Immediacy

“The option should be rapidly effective – ideally immediate. Although certain scenarios may benefit from a delayed action, these will be limited.”

Providing they work correctly and both barbs attach, both tasers are very rapid acting devices, providing an almost immediate effect. If anything, in video evidence and observations by the author in the USA, the X26 seems to cause a more rigid “locking up” of the subject but both seem to be equally effective. If the claim that the X26 is more effective in stimulating skeletal muscles is true then the falls following X26 application may be less controlled. The DOMILL statement on the medical implications of the X26 (Appendix F) anticipates “...a greater likelihood [than with the M26] of head contact with surfaces following use of the X26.” It goes on to state that the overall risk of serious head injury is low.

6.2.3 Subject Population

“The option should be effective against the maximum proportion of the population, taking account of both permanent and transitory effects (e.g. ergonomics/drunkenness).”

All taser devices are effective against a high proportion of the population, including those who are drunk or who are suffering from the effects of drugs or a mental illness. Reasons for the device being ineffective are likely to be the same for both models, relating to the reliability of the taser unit or insufficient training, rather than the ineffectiveness of the electricity.

A full list of reasons why tasers could fail can be found in the previous PSDB report. However, a major issue that has come to light during this set of tests is a low reliability amongst the X26 units supplied. Section 4.6 sets out the faults encountered during these tests. These X26 units were early production models and PSDB received 20 replacements and tested them repeatedly over a month long period. Section 4.7 shows the results of these tests. None broke down entirely during the test but two units' pulse repetition rates slowed significantly (thus reducing the power being delivered). This shows an improvement over the previous units but should not be regarded as definitive reliability testing.

6.2.4 Ease of Operation

"The option should be capable of being operated by one officer. It should be suitable for use by the majority of officers with appropriate training, regardless of physical size or gender. It should not rely on complex motor skills."

The X26 is significantly smaller than the M26, being approximately half the size and less than half the weight. The M26 has a harder trigger pull.

More than 20 officers out of 38 in the handling trials commented upon the ease of activating the trigger and safety switches on the X26 compared to those on the M26. Several also mentioned the comparative lightness of the unit, the ease of changing the batteries and the contrasting colour of the blade and fin sights. However, some officers preferred the larger size of the M26 and said that it "felt more substantial" and was more likely to be retained in the event of a struggle.

In the comparison handling trials, the questionnaire included six questions relating to the ease of use and handling of the various taser devices. The individual questions are detailed in Table 6.1 along with the percentage of participants who either tended to agree or strongly agreed with the statement.

Question	X26	M26	M26 Previous
The device is easy to point and aim	95	87	98
The device is easy to load and unload	100	89	98
The device is easy to operate, including the safety switch and trigger	95	39	97
After completion of all the exercises, I felt confident in handling and using this device	100	84	97
The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle	71	76	97
The batteries are easy to change	86	44	86

TABLE 6.1 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to the Ease of Operation of the Taser Devices. "M26 Previous" refers to the 2002 PSDB Handling Trials*

Table 6.1 shows that the X26 consistently scored more highly in the questions that relate to ease of operation. The M26 scored far worse in comparison to the previous handling trials. This probably reflects the effect of a side-by-side comparison on supposedly subjective questions and how poorly the respondents rated the Tasertron models in the previous trial. The M26 was regarded as a better fit in the hand and more easily retained in a struggle.

Chapter 5 of this report gives a detailed description of the handling trials and results from the questionnaires. Officer opinion was clearly in favour of the X26.

6.2.5 Judgement

“The option should minimise the number of judgement issues arising from its use (i.e. clear intention/targeting/outcome).”

This issue is a matter for ACPO, although clearly the issues are the same for both weapons.

6.2.6 Injury/Lethality

“The option should minimise the risk of injury to any person of serious injury and or/lethality at all times.”

In July 2004 DOMILL produced a second statement on the M26, which also provided for the extension of the ACPO operational trial to all forces and can be found in Appendix E of this report. It included a review of the information provided by Dstl following their investigation of the residual medical concerns raised by DOMILL in their first statement which can be seen at the end of Appendix E. The research requested by DOMILL on the effects of M26 cardiac currents was carried out by Dstl.

Effect of drugs of abuse

The effect of drugs of abuse on cardiac function were examined *in vitro*. The results, together with evidence taken from a literature review, leads the statement to “...suggest that some frequently abused drugs have the potential to contribute to any cardiac-related morbidity or mortality that may arise in the context of taser use.” It also goes on to suggest that it seems reasonable to generalise this conclusion into other emotionally charged and/or violent confrontations with the police. These adverse effects will depend upon several risk factors, including dose consumed, co-use with other drugs and pre-existing heart disease. Essentially, officers should be aware that an adverse medical response after taser deployment (as with any other use of force) may be more likely in drug-impaired individuals and that any unusual behaviour may signal the need for early medical intervention. The ACPO Guidance to Users takes account of these situations.

Vulnerability of pacemakers and other implantable electronic devices

Published material on the construction of these devices and the interaction of external electromagnetic fields with them was reviewed. The statement concludes that the probability of direct impact and physical damage is very low and that the effects of M26 electrical fields on the function of cardiac pacemakers are unlikely to be permanent. As the age profile of cardiac pacemaker recipients is significantly different from the overall population and that of those arrested in situations where taser may be deployed, the probability of such a person being in such a situation is considerably lower than the overall incidence of pacemakers in the population. The statement concludes that there “...is no requirement to undertake experimental studies on the vulnerability of active implantable medical devices to the output of the M26 Taser.”

Safety of the laser sights

The laser sights on the M26 have now been classified as 3R according to the British laser safety standard BS EN 60825-1³. This class exceeds the internationally agreed maximum permissible exposure (MPE) values (1mW). Due to the safety factors in MPE values, they are unlikely to cause eye injuries for accidental exposures but intentional viewing should be avoided. The manufacturers inform us that the laser sight in the X26 is a different component but that it is built to the same specification.

The **overall conclusion** of this second M26 statement is that the risk of life-threatening or serious injuries from the M26 Taser is very low.

DOMILL have also now produced a statement on the comparative medical implications of use of the X26 and M26 tasers, which is included as Appendix F of this report. To inform DOMILL, Dstl undertook groundbreaking experimental work, including modelling the path of current flow in the body, and its intensity, from both tasers using computational electromagnetic modelling (CEM). The current flow in the heart was predicted, and these data enabled application of appropriate currents to a biological model: an isolated beating heart preparation (the Langendorff preparation). DOMILL also requested a review of experimental work undertaken by, or on behalf of the manufacturers to support the introduction of the X26; operational and training data compiled by the manufacturers and global police forces; and medical assessments undertaken by organisations and individuals unconnected with the manufacturers.

Effects of predicted taser currents on cardiac rhythm

The experimental work investigated two cardiac phenomena:

- Ventricular ectopic beats (VEBs) – cardiac contractions outwith the normal inherent rhythmicity of the heart; and
- Ventricular fibrillation (VF) – chaotic, asynchronous contractions of the heart muscle fibres that result in no effective heart output. If uncorrected, this would lead rapidly to death.

It was found in Langendorff preparation hearts that neither the M26 nor X26 simulated waveforms could evoke VEBs. However they could be evoked if the peak current densities were increased above those predicted by the modelling. However, the safety margin was 60-fold. It was also found that neither the M26 nor X26 simulated waveforms could evoke VF within the maximum output of the equipment – at least a 70-fold increase for the M26 and a 240-fold increase for the X26. This, coupled with the fact that the hearts of larger animals (including humans) are less susceptible to VF leads to the conclusion that “On the basis of the present study, it is considered unlikely that the electrical discharge from the M26 and X26 Taser devices will influence cardiac rhythmicity by a direct action on the heart of healthy individuals.”

Contributing factors to cardiac susceptibility

The statement goes on to state that:

“The possibility that other factors, such as illicit drug intoxication, alcohol abuse, pre-existing heart disease and cardioactive therapeutic drugs may modify the threshold for generation of cardiac arrhythmias cannot be excluded. Similarly, other indirect responses to Taser deployment (e.g. arrhythmias precipitated by stress- or exercise-induced catecholamine release) may, in themselves, predispose [the individual] to an adverse cardiac outcome independently of the primary (electrical) action of the Taser devices.”

Falls to the ground

If the claim that the X26 is more effective than the M26 in stimulating skeletal muscle is true then falls caused by its application may be less controlled. The statement says that there may be “...a greater likelihood [than with the M26] of head contact with surfaces following use of the X26.” This will increase the likelihood of head injury, although the overall risk of serious head injury is low.

The **overall conclusion** of this X26 statement is that “The risk of a life-threatening event arising from the direct interaction of the currents of the X26 Taser with the heart,

is less than the already low risk of such an event from the M26 Advanced Taser.” However, DOMILL goes on to recommend that the monitoring system should stay in place so that any unexpected injuries can be identified and acted upon quickly.

Flammability

The further testing carried out in Section 3.4 has shown that there is a significant risk of ignition if a taser is fired at a target that has been previously sprayed with either CS or PAVA incapacitant spray. Therefore, **it is strongly recommended that the taser is not used against a subject who has already been sprayed with either CS or PAVA, when they are present with a flammable solvent, if it is possible to avoid doing so.**

CS spray is more likely than PAVA spray to ignite. The risk is lowest if there is no clothing, or tight clothing, due to the lack of an air-gap and its associated spark. The results with an introduced air-gap can also be used to represent use of the taser in “drive-stun” mode. However, it is important to note that, although the PAVA solvent is less likely to ignite, when it does it burns with a blue flame that is very difficult to see in daylight. Hence, it may not be until the clothing catches fire that the flames would be noticed. This is especially significant if the subject is under the influence of a taser as they would be unable to alert the officer to their predicament.

The XP Cartridge

PSDB approached DOMILL for their opinion on the medical implications of using the XP cartridge. The following advice was received:

“The needle on the XP cartridge is 4mm longer than that of the “21ft. regular” cartridge. It also has a slightly higher energy. At an overall length of 13.4 mm, the XP needle could result in a defect on the internal aspect of the body wall at some anatomical locations. Bleetman* undertook ultrasonic measurements of the distance between the external body surface and various organs in 25 volunteers in an erect posture. The minimum depth for the left kidney, spleen, anterior and posterior liver, pericardium, anterior and posterior pleura were all less than 13.4 mm. The median depths ranged from 17-31 mm; superficial major blood vessels were not addressed.

“DOMILL does not know whether the XP needle will penetrate the body wall up to its shoulder. If it is assumed it can, there is a risk that the Taser needle could penetrate the outer surface of an organ. The greatest concern expressed was with regard to superficial blood vessels. In this respect, the XP cartridge has greater risks than the regular cartridge needle. The risk of this event is low, because of the small presented area of superficial major blood vessels.”

It should be noted that this advice assumes that the XP needle penetrates the skin for its entire length up to the crimping on the shaft. The XP cartridge was designed to be used against subjects who are wearing thick clothing and if used as such the risk of more serious injury will be reduced.

6.2.7 Effect

“The option should at least temporarily neutralise the threat, rendering a subject incapable of carrying out an immediate threat of violence. The duration of such incapacitation must be sufficient to permit officers to safely approach a subject and restrain them, which may include the need to overcome an obstruction (i.e. locked door/barricade).”

* Bleetman A, Dyer J (2000). Ultrasound assessment of the vulnerability of the internal organs to stabbing.: determining safety standards for stab-resistant armour. *Injury*; Oct; 31(8), 609-612

The effect of the M26 is as set out in the previous report. However, both models have the general effect of making the subject fall down to the ground or to 'freeze' them in place while their muscles are contracting. This effect on the subject remains while the electricity is flowing. As soon as the electricity ceases to flow, however, the subject **may** make an immediate recovery. Generally, the subject is likely to be dazed and confused due to the severity of the effects and may not completely recover immediately. It is also possible that their muscles will be aching and they may feel lethargic. The manufacturers of tasers recommend that the officers approach the subject whilst the electricity is being applied, rather than waiting for it to stop before advancing as this may be too late.

The taser will only be effective if both barbs are attached to the target, either through their clothing or via penetration of the skin. If only one barb is attached, the circuit will not be complete and the electricity will be unable to flow. With both taser models, it is possible to reapply charge to the subject after the initial discharge has ended, providing both barbs are still attached to the person. If one or both barbs have become detached from the target, then a new cartridge will have to be fired, unless the device is used in drive-stun mode.

Both models have a continuous discharge that lasts for five seconds after the trigger has been pulled. This can be stopped before 5 seconds have passed if required by flicking on the safety switch. However, the M26's pulse repetition rate depends on the charge level of the batteries whereas X26 units produced up to July 2004 have a digitally regulated output at 19 pulses/second for two seconds and then 15 pulses/second after that. Future X26 units will stay at 19 pulses/second. Both units can be used in drive-stun mode (touching of the unit to the subject like a stun gun) as well as being able to be used for placing the laser spot on the subject or sparking the weapon in an attempt to gain compliance without firing a cartridge.

6.2.8

Environment

"The option should be effective in all operating conditions (e.g. weather, indoors/outdoors, lighting, temperature etc.) and in confined spaces."

As both tasers use the same cartridge the wind will have no differing effect between them. In the taser handling trials, one exercise involved the use of the tasers in the dark. The operator was in an upright stationary position and the target was face on, also stationary. The results showed that the time taken to fire varied little between the models and the proportion of barbs striking these areas was comparable to those that struck when the lights were on. However, these trials were carried out in conditions where the target was just visible after the eyes had acclimatised to the darkness. In total darkness or in conditions where no acclimatisation time was given the flashlight feature on the front of the X26 would give it a clear edge over the M26. Chapter 5 provides more details of these trials.

At the taser handling trials, the questionnaires included one question in relation to the use of tasers in enclosed spaces and a further question in relation to their use in the dark. The individual questions are detailed in Table 6.2 along with the percentage of participants who either tended to agree or strongly agreed with the statement.

Question	X26	M26	M26 Previous
The device could be used in confined spaces	92	84	89
The device would be suitable for use in the dark or subdued lighting conditions	92	47	72

TABLE 6.2 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to the Use of the Taser Devices in the Dark and in Confined Spaces*

Tests were carried out at PSDB to evaluate any adverse effects caused when the taser was held at a temperature of +50°C. Also included in this report are results from Finland for a temperature of -20°C. At +50°C the X26 performed as normal except for a slightly enlarged laser sight that returned to normal after half an hour. In previous testing the M26, however, was incapable of firing at this temperature and the laser sights and battery indicator did not work. These problems were due to the taser unit itself and not the batteries or cartridges as these were found to perform as normal.

At -20°C the X26 unit itself was not affected. There was a problem with probes jamming inside the cartridges but this would be common to both weapons. In previous testing at low temperatures the M26 units became difficult to fire and the laser sights generally became diffuse, fragmented or dim. The power output was also greatly reduced due to the effect of low temperature on the batteries. This effect was most severe with alkaline batteries, but the rechargeable batteries were also adversely affected.

The testing of the taser against medical equipment in Section 3.3 has shown that there is a very low risk of the taser affecting it in a dangerous way. Further work commissioned by PSDB has shown that there is no significant risk of affecting flight critical systems of aircraft. **Extreme caution must also be exercised when using tasers in a flammable environment, such as a petrol station.**

6.2.9 Mobility/Flexibility

“The option should be effective against a moving target. It should be easily transported to the scene of an incident, and ideally portable at the scene.”

At 150 · 34 · 43mm and weighing 230g the X26 is approximately half the size and less than half the weight of the M26. The handling trials demonstrated that both tasers could be used effectively to hit a moving target.

In the comparison handling trials, two exercises involved the officers firing the taser at a moving target. One exercise involved a forward facing human target moving into a doorway and out again and the other a human target advancing towards the officer. In both exercises a high proportion of hits were recorded (95-100%).

At the comparison handling trials, the questionnaires included one question in relation to the use of tasers against a moving target. The question is shown in Table 6.3 along with the percentage of participants who either tended to agree or strongly agreed with the statement.

Question	X26	M26	M26 Previous
The device could be used effectively against a moving target	76	61	77

TABLE 6.3 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to the Use of the Taser Devices Against a Moving Target*

When this was compared to the proportion of shots from each model that successfully struck the target, i.e. both barbs struck the body without hitting the head, neck or groin area, then the tasers actually perform better than the officers' perception of them. Despite the greater number of officers who felt that the X26 would be better, the M26 in fact performed marginally better.

6.2.10 Cumulative Effects

“The use of the option should not preclude the use of other tactical options before/after. It should not increase or reduce their effects if they are subsequently employed.”

The further flammability testing in Section 3.4 showed that there is a **significant risk of any subject who has been sprayed with CS or PAVA being ignited if they are tasered**, although it has now been shown that this risk is only so high if the taser barb fails to make contact with the skin of the subject. The experimental work on the spark gap (Section 4.5.2) shows that the X26 will cross a spark gap of the same size as the M26 and so the risk of ignition will be similar.

CS is about twice as likely as PAVA to ignite. The risk is lowest if there is no clothing, or tight clothing, due to the lack of an air-gap. The results with an introduced air-gap can also be used to represent use of the taser in “drive-stun” mode. However, it is important to note that, although PAVA is less likely to ignite, when it does it burns with a blue flame that is very difficult to see in daylight. Hence, it may not be until the clothing catches fire that the burning would be noticed. This is especially significant if the subject is under the influence of a taser as they would be unable to alert the officer to their predicament.

6.2.11 Safety/Security

“The use of the option, and the equipment required, should be safe to operate and store, and should have the minimum security considerations.”

All tasers are classified as a Prohibited Weapon under Section 5 (1) (b) of the Firearms Act (1968). The acquisition and possession of these devices must therefore be in accordance with this Act. Given the nature of these devices, due consideration should also be given to their safe storage. Police forces or registered firearms dealers also need an import licence from the Department of Trade and Industry. There is currently a ban on the export of electroshock devices, including tasers, from the UK. This means that although forces would be able to import the devices, they may be unable to export them out of the country again, for instance to return a faulty weapon to the US manufacturer for repair.

The tasers should be stored at room temperature to avoid any adverse effects caused by extremes of heat or cold. The taser should not be fired near flammable liquids or fumes as it may cause these to ignite.

The X26 has all of the same high voltage electricity hazards as outlined in the previous report.¹

At the taser handling trials, the questionnaires included two questions in relation to safety aspects during taser use. The individual questions are detailed in Table 6.4 along with the percentage of participants who either tended to agree or strongly agreed with the statement. At the handling trials, 3 participants out of the 38 who attended reported receiving an electric shock through their fingers while using the tasers.

Question	X26	M26	M26 Previous
The device is safe to use without risk of electric shock to the officer	97	97	95
The device could not easily be discharged unintentionally	74	79	75

TABLE 6.4 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to the Safety of the Taser Devices*

Also at the handling trials the officers felt that the M26 would be easier to retain in the event of a struggle.

6.3 Other Issues

This section addresses the eleven points raised in the 'Other Issues' section of the Operational Requirement. As before, each point raised is written in bold text and is enclosed within inverted commas, “ ”. This is then followed by PSDB's response to that point.

6.3.1 Repeat Operation – Speed of Multiple Use

“Are repeated applications of the option likely to be required? How feasible is such repetitive operation (by one officer/several)?”

Repeat shots from the taser may be necessary due to the proportion of shots that result in one or both barbs missing the target (9% in the handling trials, see Section 5.2.2). Both taser models can only fire one shot before a new cartridge needs to be inserted but they are relatively easy to load and unload and only require one officer to do this. In addition both have a grip extension that allows an extra cartridge to be carried on the weapon itself.

It is possible with both models of taser to reapply charge to the subject after the initial discharge has ended, providing both barbs are still attached to the person. If one or both barbs have become detached from the target, then a new cartridge will have to be fired unless the devices are to be used in touch-stun mode.

In the taser handling trials, one exercise involved the officers firing multiple shots from the taser. The taser was initially loaded and the officer had to draw the unit and fire three cartridges in quick succession, reloading as necessary. The time taken to do this ranged from 4.7-11.7 seconds for the M26 and 4.0-8.7 seconds for the X26, depending on the officer. The X26 on average was reloaded more quickly. The range in times demonstrated that some officers found the process of loading, aiming, firing and unloading more difficult than others did. This could probably be addressed by training.

At the taser handling trials, the questionnaires included one question in relation to the ease of loading and unloading the taser models. Table 6.5 details this question, along with the percentage of participants who either tended to agree or strongly agreed with the statement.

Question	X26	M26	M26 Previous
The device is easy to load and unload	100	89	97

TABLE 6.5 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to the Ease of Loading and Unloading the Taser Devices*

It can be seen that the majority of participants were satisfied with the ease of loading and unloading the tasers, with greater satisfaction expressed for the X26 model.

6.3.2 Specialist vs. General Use

“Is the option appropriate for deployment in all officer roles, or only by specialists (e.g. dog-handlers, Tactical Firearms Units, new team)?”

The issue of who should carry various less lethal devices, including tasers, is a matter for ACPO and Ministers. However, the smaller size of the X26 means that it would fit onto a utility belt more easily and that it could be carried covertly. The taser handling trials included one question that asked for officers’ opinions on the appropriateness of tasers being deployed in all officer roles. The question is detailed in Table 6.6 along with the percentage of participants who either tended to agree or strongly agreed with the statement. There was no clear consensus amongst those who gave reasons.

Question	X26	M26	M26 Previous
The device is appropriate for deployment in all officer roles	63	47	51

TABLE 6.6 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to the Deployment of the Taser by All Officers*

6.3.3 Training

“What are the training periods associated with the option’s deployment, both initially and in terms of refresher training? What training facilities are required?”

ACPO have produced a training procedure for the M26 taser. This could be easily adapted for the X26. In the taser handling trials, the participants were given a 2 hour ‘familiarisation’ session with the tasers. This involved them being briefed on the various models and how to handle and use them safely and correctly, then firing one cartridge from each of the two tasers. They then each fired 9-12 shots from each taser model throughout the various exercises. Following the handling trials, they were asked in the questionnaires how confident they felt about using the devices after they had handled them during the preceding familiarisation training and exercises. The question is detailed in Table 6.7 along with the percentage of participants who either tended to agree or strongly agreed with the statement.

Question	X26	M26	M26 Previous
After completion of all the exercises, I felt confident in handling and using the device	100	84	97

TABLE 6.7 *Percentage of Participants Who Agreed With the Question Being Asked in Relation to Their Confidence in Handling the Taser Devices*

6.3.4 Costs

The prices given in this section are as quoted by Pro-Tect Systems Ltd, the only UK supplier of Taser International products and are correct as of June 2004.

Product	Cost (Excluding VAT)	Additional features
M26 Taser (Black or Yellow)	£395	Including rechargeable NiMH battery pack and secondary cartridge holder.
X26 Taser (Black or Yellow)	£750	Including extended warranty and 3 Digital Power Magazines (2 × XDPM, 1 × DPM) and holster.
Cartridges each (15ft, Standard 21ft and 21ft LS)	£15	
Cartridges each (25ft XP)	£16.50	
DPM each	£25	
XDPM each	£30	
M26 battery charger	£49.50	
Set of 8 NiMH batteries for M26	£19.50	
Protective training suit	£350 (approx.)	Free with first order of 1000 cartridges
M26 serial port dataport download software/adaptor	£95	
X26 USB dataport download software/adaptor	£95	

TABLE 6.8 *Price List for Taser Products, Cartridges and Accessories. All prices excluding VAT*

6.3.5 Legal Implications

“Would the adoption of the option require new legal authority (e.g. prohibited weapons)? What are the tactical considerations in the light of Human Rights (e.g. proportionality, least intrusive option)?”

Many of these issues have been dealt with by ACPO, the Home Office and the NIO. It should be reiterated that the taser is classified as a Prohibited Weapon under Section 5 (1) (b) of the Firearms Act (1968). The acquisition and possession of these devices must therefore be in accordance with this. There is also currently a ban on the export of electroshock devices, including tasers, from the UK. This means that, although forces would be able to import the devices, they may be unable to export them again, for instance to return a faulty weapon to the US manufacturer for repair.

6.3.6 Acceptability (Police and Public)

“What is the external and internal impact assessment associated with the options considered?”

This issue is a matter for ACPO, the Home Office and the NIO.

6.3.7 Visual Effect (on Subject/Third Party)

“Does the option involve equipment looking like a firearm? Can the option be carried/used covertly?”

Both taser models are basically gun-shaped. However, the M26 more closely resembles a firearm in size and appearance. Both units can be manufactured in yellow.

A variety of other colours may also be available if demand is sufficient for this to be financially viable for the manufacturer. This should help signify both weapons as being less lethal, although identification problems may still exist in very dark conditions.

The M26 is too large for effective covert use. The smaller size of the X26 would make it more suitable for this role. However, some officers in the handling trials preferred the larger size of the M26 saying that it looked “more like a serious weapon” and thus would have a greater deterrent effect.

6.3.8 After-Effects

“How long do potential after-effects last? What treatment/training is required to deal with potential after-effects?”

The after-effects are the same as those for the M26 covered in the previous report. As soon as the electricity ceases to flow, the subject **may** make an immediate recovery. In reality, the subject is likely to be dazed and confused due to the severity of the effects and may not completely recover immediately. It is also possible that their muscles will be aching or tingly and they may feel lethargic. However, the most intense effects of the taser only last for the duration that the electricity is applied.

In addition to the after-effects that may result from the high voltage electricity that has travelled through the subject’s body, potential after-effects could also be caused by a number of other sources, such as:

- ☐ The taser barb penetrating the subject's skin. This may not occur in every case as the barb often attaches onto the subjects clothing. However, if the barb has penetrated the skin, it needs to be safely removed afterwards. On this subject DOMILL advises that “...needles/barbs should be removed by medical staff, principally because of the requirement for infection control, the potential for additional trauma to the skin and superficial tissues of the subject, and risk of self injury. This is particularly important with regard to the XP cartridge where perforation of the body wall could have occurred. If there is an operational necessity for police officers to remove the needles/barbs, they must be trained in the risks. Needles/barbs in particularly vulnerable areas such as the eyes, should always be removed by medical staff only.”
- ☐ Blunt trauma secondary injuries caused by the tasered person falling after being subjected to the electricity. Other injuries may also result if they fall onto a dangerous material such as glass or a noxious substance; and
- ☐ Injuries caused by unintentional effects, such as injury to the eye caused by the taser barb striking the eye, or the projected laser sight from the taser being directed into the eye. In addition, injuries may result due to ignition of a subject who is tasered whilst they have a flammable liquid on them.

6.3.9 Durability

“How robust is any equipment required for an option? Over what period can an option be said to be reliable – what checking is required?”

PSDB carried out drop tests on the X26 taser, which involved dropping the unit from a height of 2m onto a steel plate. It should be noted, however, that only two units were dropped as a representative sample. They were randomly selected from production line models but it does mean that there could be a large error due to such a small sample size. Damage was largely limited to the safety switch and cartridges. This is similar to the damage sustained by the M26 model.

There was a more significant problem with the reliability of the taser units. One M26 out of five bought for the comparison handling trials failed during those trials.

However, out of 11 X26 taser units acquired, in a 6-month testing period, 7 have ceased to function (not counting those used in the drop test). These X26 units were early production models and PSDB received 20 replacements and tested them repeatedly over a month long period. None broke down entirely during the test but two units' pulse repetition rates slowed significantly (thus reducing the power being delivered). This shows an improvement over the previous units but should not be regarded as definitive reliability testing.

6.3.10 Authority Required to Use

“Who should authorise the use of the option? Who should review its use, when, and how often?”

This issue is a matter for ACPO and Ministers.

6.3.11 Audit Trail

“Does the option have a secure system for recording use? Will this enhance a documented system for decision making?”

The X26 has an improved dataport for recording information about the taser's use. Whereas the M26 stores the time and date of the last 585 firings, the X26 records the time, date, duration, temperature and battery status of the last 2000 firings. Furthermore it does this in encrypted data files. This data is downloaded to a computer via a USB connection.

As both the X26 and M26 use Taser International cartridges they will both have serial numbers and AFID (Anti-Felon Identification) discs. Every time these cartridges are fired, up to 40 small confetti-like identification tags (AFIDs) are ejected and scattered in the surrounding area. Each AFID disc shows the serial number of the cartridge used. The cartridges have their serial number printed on a sticker. However, these are relatively easy to remove or replace. Obviously, for any audit trail to be effective, it needs to be backed up by a suitable logging system within the force in order to know which officers have been issued with which tasers and cartridges.

6.4 Conclusions

The comparison to the individual requirements in the OR has demonstrated that the X26 outperforms the M26 or that there is little difference between the models. However, in a number of requirements this is not the case. The biggest drawback of both units continues to be the maximum possible range of 21ft (6.4m) and general effective range of 15ft (4.6m), although this latter distance seems to have improved slightly with the X26. The reason for this improvement is probably that the probes strike higher than the laser sight at shorter distances.

When compared to the OR, the X26's superior characteristics are:

- ☐ Ease of operation and generally better handling characteristics;
- ☐ Full functionality in a greater range of environments (darkness and extreme temperatures);
- ☐ The taser unit is smaller and lighter than the M26, which means easier carriage;
- ☐ Speed of use and reloading;
- ☐ A more robust audit trail with 2000 firings logged, more parameters recorded and encrypted usage files; and
- ☐ Less risk of causing a life-threatening event in the heart than the already low risk associated with the M26.

The X26's most serious negative aspects are:

- ☐ A cost double that of the M26;
- ☐ Possible reliability issues; and
- ☐ A possible slightly increased risk of head injury arising from a less controlled fall.

When compared to the OR, the M26's superior characteristics are:

- ☐ More difficult to discharge unintentionally;
- ☐ Half the cost of the X26;
- ☐ More effective visual deterrent; and
- ☐ The larger size makes it easier to grip and retain.

The M26's most serious negative aspects are:

- ☐ The device is shaped more like a firearm;
- ☐ It is more difficult to fire due to its trigger mechanism.

The advantages and disadvantages of each of the different models must be considered when deciding which would be most appropriate for use in particular operational situations. However, if a force decided to use both weapon systems there could be disadvantages in terms of cost, training, documentation and operator confusion.

7

OVERALL CONCLUSIONS

This report has covered two main areas of work: addressing the residual concerns over the use of the M26 and comparing the Taser International Taser X26 to the M26 Advanced Taser (the latter has been approved for operational use in support to firearms).

7.1

Residual Concerns over the M26

- ☐ The laser sight from the M26 has been tested and can be classified as 3R according to the British laser safety standard BS EN 60825-1.³ Although this class exceeds the internationally agreed maximum permissible exposure (MPE) values (1mW), because of the safety factors in MPE values, they are unlikely to cause eye injuries for accidental exposures. However, intentional viewing must be avoided. In order to conform to this standard the labelling requirements outlined in Appendix A1.3, Table A3 must also be implemented. The laser sights in the X26 are claimed by the manufacturer to be built to the same specification as those in the M26.
- ☐ The testing of the M26 taser against medical equipment in Section 3.3 has shown that there is a low risk of the taser affecting it in a dangerous way. Further testing commissioned by PSDB has indicated that there is no significant risk of affecting the on board systems of aircraft in flight.
- ☐ The further testing described in Section 3.4 has shown that there is a significant risk of ignition if a taser is fired at a target that has been previously sprayed with either CS or PAVA incapacitant spray. CS spray is about twice as likely as PAVA spray to ignite but PAVA solvent burns with a blue flame that is difficult to see in bright light conditions. The risk is lowest if there is no clothing, or tight clothing, due to the lack of an air-gap and the consequent reduction in sparking. Therefore, it is strongly recommended that the taser is not used against a subject who has already been sprayed with either CS or PAVA, when they are present with a flammable solvent, if it is possible to avoid doing so. Extreme caution must also be exercised when using the taser on a subject who is suspected of being covered in any other flammable liquid, such as strong alcohol (e.g. undiluted spirits) or petroleum spirit, or in a dangerous environment, such as a petrol station.
- ☐ The residual medical concerns over the M26 taser raised by DOMILL have been investigated by the Defence Science and Technology Laboratory (Dstl). The information provided was reviewed by DOMILL and contributed to their second statement on the M26, which is included in the Appendices of this report. It concludes that the risk of life-threatening or serious injuries from the M26 Taser is very low.

7.2

Comparison of the Taser X26 with the M26 Advanced Taser

Throughout the testing and the handling trials, and when compared to the Operational Requirement *the X26 taser performs better than the M26 in most areas*. Furthermore 79% of officers in the handling trials expressed a preference for the X26. However:

- ☐ The X26 is approximately twice the cost of the M26;
- ☐ Of the eleven X26 units supplied to PSDB, discounting the two that were used in drop-testing, seven broke down under no more duress than repeated usage in a 6-month period. These X26 units were early production models and PSDB received 20 replacements and tested them repeatedly over a month long period. None broke down entirely during the test but two units' pulse repetition rates slowed significantly (thus reducing the power being delivered). This shows an improvement over the previous units but should not be regarded as definitive reliability testing.

When the medical implications of the use of the X26 were examined by DOMILL it was concluded that "The risk of a life-threatening event arising from the direct interaction of the currents of the X26 Taser with the heart, is less than the already low risk of such an event from the M26 Advanced Taser." DOMILL also noted that if the X26 is more effective than the M26 in stimulating skeletal muscle, as claimed, then there will be a greater likelihood of head injury after contact with surfaces due to the less controlled fall. However, the risk of serious head injury is still considered to be low.

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ACKNOWLEDGEMENTS

The author wishes to thank the following people for their assistance throughout PSDB's evaluation of taser devices and the compilation of this report.

For testing the laser sights:

- ☐ Dr John O'Hagan at the National Radiological Protection Board
- ☐ Ken Henman of the University of Hertfordshire Department of Physics

For the examination of electromagnetic compatibility with hospital equipment:

- ☐ Dr Stephen Young of the Royal Brompton Hospital
- ☐ Brian Clancy and Paul Davis, Clinical Engineers at the Luton and Dunstable Hospital
- ☐ Catriona McNie, Principal Medical Device Specialist at the Medicines and Healthcare products Regulatory Agency (MHRA - formerly the Medical Devices Agency)
- ☐ At PSDB, Chris Malbon and Chris Georgiou

For the M26-CS/PAVA flammability testing:

- ☐ At PSDB, Chris Georgiou and Martin Macfarlane

During PSDB X26 testing and comparison handling trials:

- ☐ All participants in the handling trials
- ☐ Inspector Dave Orford and Dave Logan of the Cleveland & Durham Police Tactical Training Centre
- ☐ At PSDB, Christine Hussain, Paul Daniels, Karen Douse, Chris Georgiou, Chris Malbon, Mark Famy, Sam Davies, Chief Inspector Rick Prior, Tim Baldwin, David Spence, Daniel Longhurst, Ted Holyoake, David Neil, Matthew Symons, Martin Macfarlane, Graham Smith and Graham Parker

For the preparation of the report:

- ☐ Lt Tapani Hack of the Police Technical Centre in Finland for kindly sharing his data on cold temperature testing of the X26 taser.
- ☐ At PSDB, Martin Macfarlane, Christine Hussain and Karen Douse
- ☐ Dr Graham Cooper of Dstl

Appendices

A DETAILS FROM THE FURTHER TESTING OF THE M26 ADVANCED TASER

A 1 Details from the Assessment of the Output from Laser Sights

A 1.1 Laser Radiation Measurements – Wavelength

The wavelength of the beam was measured using an Ocean Optics USB2000 spectrometer, serial number USB2E2823 (wavelength sensitive range 200 to 850nm). The results are set out in the table below (Table A1).

Unit Type	Serial Number	Wavelength / nm
M26	P000451 11/99	649
M26	P1-007965 02/01	653
M26	P1-007968 02/01	653
M26	P1-007970 02/01	656
M26	P1-009366 02/01	653
M18L	L1-002018 02/01	655
M18L	L1-002020 02/01	653
M18L	L1-002021 02/01	654
M18L	L1-002022 02/01	654

TABLE A1 *The wavelength of the beams emitted from nine laser sights from Taser International M26 Advanced and M18L Tasers*

A 1.2 Laser Radiation Measurements – Power Output

The radiant power of the beam was assessed using two Coherent Fieldmaster laser power meters, serial numbers ES04 and GF34 with Coherent LM2 detectors, serial numbers EB29 and GF29, respectively (wavelength sensitive range 400 to 1064nm). The results are set out in the following table (Table A2).

Unit Type	Serial Number	Power Output / mW
M26	P000451 11/99	0.41
M26	P1-007965 02/01	2.8
M26	P1-007968 02/01	2.6
M26	P1-007970 02/01	2.6
M26	P1-009366 02/01	2.7
M18L	L1-002018 02/01	3.0
M18L	L1-002020 02/01	2.9
M18L	L1-002021 02/01	2.8
M18L	L1-002022 02/01	

TABLE A2 *The power outputs of the beams emitted from nine laser sights from Taser International M26 Advanced and M18L Tasers*

A 1.3 Comparison of the M26 Taser label to the relevant labelling criteria

The following table (Table A3) is a comparison of the new label to the labelling criteria covering class 3R lasers. The references are to the relevant numbered clauses in BS EN 60825-1.³ Highlighted areas indicate clauses that are not met by the current labelling.

Clause	Requirement	Comment
5.1	Labels can be read without exposure to laser radiation in excess of class 1	Existing label can be read
5.1	Label shall be permanently fixed	Existing label appears to be permanently fixed
5.1	Label shall be clearly visible during operation	The label is located on the bottom of the taser and is not visible during operation
5.1	Text borders and symbols shall be black on a yellow background	Text is black on a white background
5.4	A laser warning label shall be affixed (laser starburst symbol, black on yellow background)	There is such a label but it is black on a white background.
5.4	A class 3R laser product shall have an explanatory label bearing the words: "Laser Radiation. Avoid direct eye exposure. Class 3R laser product"	Product is marked under the US Federal Product Performance Standard as IIIA
5.7	Class 3R laser products should have a label affixed close to the aperture with the words "Laser Aperture" or "Avoid Exposure – Laser Radiation is Emitted from this Aperture"	The aperture is marked with an arrow and the words "Avoid Direct Eye Exposure – Laser Light is Emitted from this Aperture (Danger)". The word "light" may be used as the wavelength is in the visible spectrum
5.8	An explanatory label should give a statement of the maximum output of laser radiation, emitted wavelength and the name and publication date of the standard to which the product was classified.	The maximum output is provided as 5mW and the wavelength range appears to be correct. British Standard details are not included.
6.1 a)	Adequate instructions for safe use	The manual contains no information on the laser nor is it mentioned in Taser International's Master Instructor presentation. However, the General Warning includes "Never point the Advanced Taser at another person unless intended for use" and "Never aim the Advanced Taser at the eyes or face". This can be covered in training.
6.1 c)	A statement of the beam divergence and maximum output	Not given in manual
6.1 d)	Legible reproductions of all labels and hazard warnings	Not given in manual
6.1 e)	Clear indication in manual of location of laser aperture	This is implied on the Advanced Taser's Features diagram in the manual.

TABLE A3 *A comparison between the requirements for labelling of British Standard BS EN 60825-1 and the labelling/documentation supplied with the Taser International M26 Advanced Taser*

A 1.4 Details of Measuring the Laser Power Output under Increased Voltage Conditions

A1.4.1 Introduction

The NRPB classification of the lasers as class 3R was dependent upon there being “no failure modes in the electronic circuit that could significantly increase the radiant power of the laser beam.” The circuit involving the laser beam and the enabling switch (the taser’s safety switch) contains a ZXCL Series chip (ZXCL400H5) which is a “Low Dropout Regulator”. This means that its purpose is to protect a component (in this case the laser) from thermal overload, too much current or too high a voltage. It was apparent that the failure mode that would increase the voltage supply to the laser by the greatest amount was a short circuit directly from the batteries to the laser. This would be a voltage of 9.6V in the case of NiMH batteries* or 12V in the case of alkaline batteries. In order for these lasers to be regarded as class 3R the radiant power must not go above 5mW. This test subjected the laser modules to a voltage input nearly 3 times higher than the alkaline batteries (32V).

A1.4.2 Specifications of the Laser Used in the Sighting Mechanism†

The following table contains certain parameters of the laser that is used by Taser International.

Parameter:	Minimum	Typical	Maximum	Units
Optical power	2.3	3.0	4.5	mW
Operating voltage	3.1	3.3	3.5	V
Operating current	-	-	40	mA
Wavelength at peak emission	-	650	-	nm
Operating temperature range	-10	26	50	°C
Storage temperature range	-40	-	85	°C
Beam focus distance	-	10	-	m
Dot size at focus distance	-	-	10- 11	mm

TABLE A4 *Elements of the M26 Laser Module Specification, as supplied by Taser International.*

From the information in Table A4 the lasers would be expected to fall into the 3R classification. The PSDB test covered the voltages in the specification before increasing to the full voltage that can be supplied by the taser’s batteries and beyond. The typical Optical Power and Operating Voltage was highlighted in the results. The maximum current drawn by the laser from the power supply was also noted.

A1.4.3 Test Method

The lasers were removed from six Taser International devices (2 M26 Advanced Tasers and 4 M18Ls). Each was connected to a Thurlby 30V-2A PC320 power supply. The laser power output was measured using a UDT Instruments 350 Linear/Log Optometer attached to a Meter-Type 247 measuring head. The voltage was increased in increments from 2.5V until either the laser ceased to function or 32V was reached. The laser power output was recorded for each voltage.

A1.4.4 Results

The following graph (Figure A1) shows the results. The serial number of the taser from which each laser was taken is shown.

* Nickel-Metal Hydride batteries. They are rechargeable and also the manufacturer’s recommended type.

† As supplied by Taser International

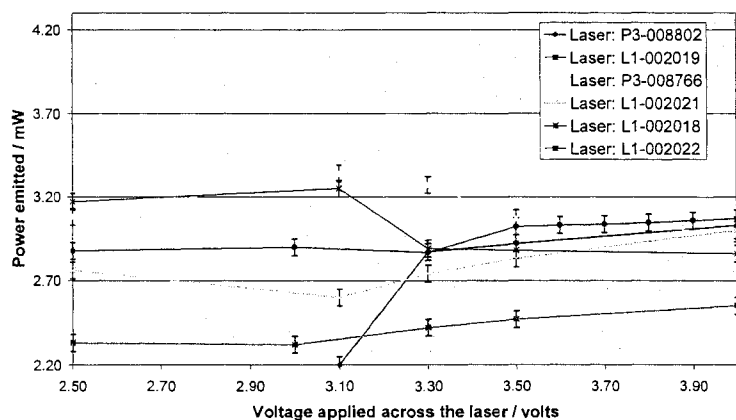
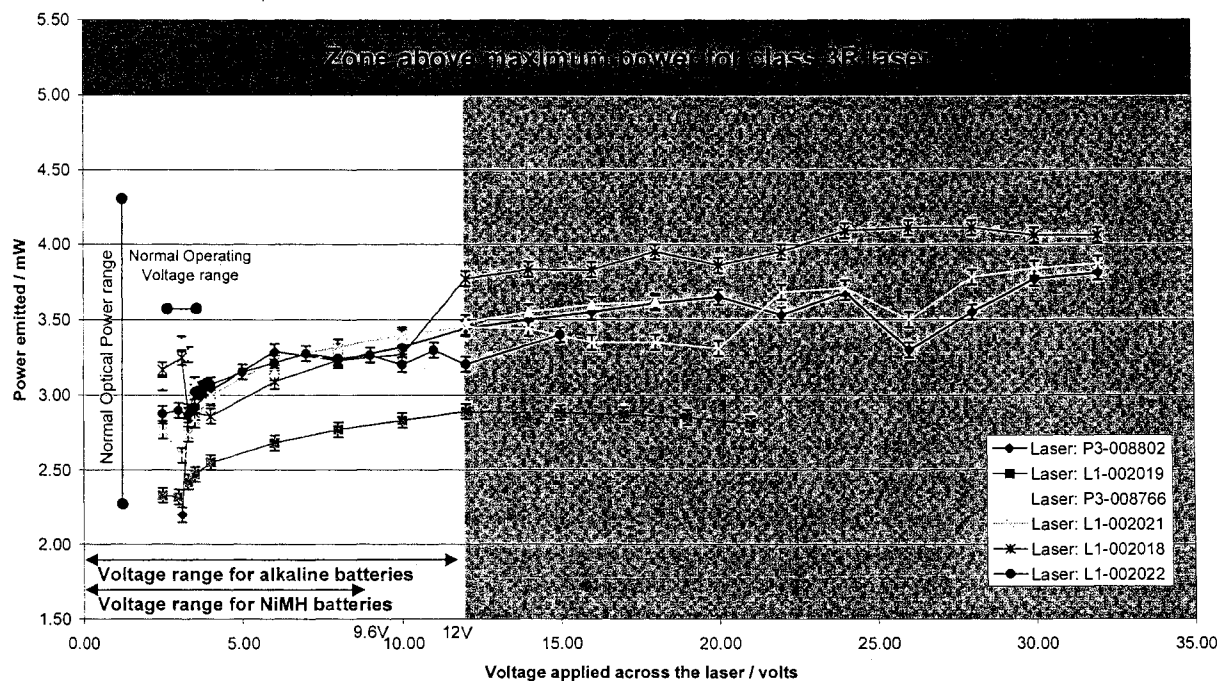


FIGURE A1a,b Graph showing the power output from 6 Taser International laser sights for increasing voltage (above). The second graph (left) shows the normal optical power range versus the normal operating voltage range.

The graph shows the normal operating voltage and optical power ranges as quoted by Taser International. It also shows the voltage ranges for the two types of battery and the zone above 5mW on the y-axis is the power output that is above a class 3R laser. The maximum power output achieved by any laser was $4.11(\pm 0.05)\text{mW}$. The maxima achieved within the limits of voltages supplied by alkaline and NiMH batteries were $3.77(\pm 0.05)\text{mW}$ and $3.38(\pm 0.05)\text{mW}$ respectively. All of these results are clearly below the 5mW limit. Three of the lasers ceased to function between 15V and 23V - one of which exploded. The current drawn by the laser varied between 18mA and 42mA.

A 2 Details From the Assessment of the Electrical Compatibility of the M26 Taser with Various Medical Devices

A 2.1 Method

The testing took place at the Luton and Dunstable Hospital in September 2003. Various pieces of equipment were collected together for evaluation in the medical engineering laboratory.

The medical equipment was set up to function within normal operating parameters and, in the case of monitoring devices, suitable artificial means for providing readings were connected. As the greatest electromagnetic field was found to occur when a taser has a cartridge with wires extended and a load between them (see Section 3.3.2 of this report), the taser in this test was similarly set up. The taser was activated and whilst it was discharging was moved at a steady rate over all accessible surfaces of the medical device. At some points the wires from the taser were trailing over the equipment. Any observable effects were noted and then the test was repeated at 0.5m from the equipment. If any previous effect was no longer noticeable then the taser was moved closer to ascertain the largest distance at which the anomaly occurred. If there was an effect at half a metre then the taser would be moved away until the effect ceased.

A 2.2 Results

In the hospital there was only one external pacemaker available and this was to be used on a patient on the same day so it was decided not to risk damage by carrying out a test on it. Similarly, permission to test the ventilators was not given. The results from the remaining pieces of equipment on the test list (Section 3.3.3) are shown in Table A5.

Equipment Type	Make/Model	Effect at 0.0m	Effect at 0.5m
ECG Monitor	Kontron Micromon 7142	Occasional spike on the QRS wave. For 1 second gave a false reading of 71bpm. No other noticeable effects. In the opinion of the clinical engineer present these effects would not be potentially harmful.	None.
ECG Monitor	Dash 3000 (ECG mode)	None.	None.
Observation Monitor	Dash 3000 (SpO ₂ mode)	None.	None.
Observation Monitor	Nellcor Puritan Bennett NPB 4000	Additional spikes all over the ECG trace. Respiratory alarm sounded. In the opinion of the clinical engineer present these effects would not be potentially harmful. Both went back to normal immediately after the taser discharge ceased.	No observable effects at 0.5m. The effects observed at 0.0m continued to manifest up to 0.2m away from the equipment.
Baby heart monitor (sound)	Hewlet Packard 8040A	None.	None.
Automatic External Defibrillator (AED)	Zoll M Series	None.	None.
Syringe Pump	Graseby 3500	None.	None.
Volumetric Pump	Imed Gemini PC-1 Infusion	None.	None.
Dialysis Machine	Fresenius Medical Care 4003	None.	None.

TABLE A5 *Effects of activating a taser in close proximity to and 0.5m away from medical equipment*

As can be seen from the table, the only observable effects were on ECG/Respiratory monitors. In these cases the effect would not have injured the patient and the equipment reverted to normal functionality as soon as the taser was switched off. All of the other equipment functioned normally throughout the test. The test was repeated with no cartridge in the taser (drive-stun mode) and there were no effects on any of the equipment at either distance.

Unfortunately, the ventilators were unavailable. Older ventilators are largely mechanical and thus less susceptible to electromagnetic interference. Newer ones are often computer controlled and so would be more susceptible. However, given that life support devices should be designed to resist electrical interference of up to 10Vm^{-1} and the evidence in Section 3.3.2 of this report, it can be assumed that the likelihood of interference occurring at one metre is very low.

A 3 Full Results from the Investigation of The Flammability of The Solvents in CS and PAVA Incapacitant Sprays When Used Alongside Tasers

A 3.1 CS with no air gap

Spray Number	Reduction in Can Weight (g)	Quantity Sprayed (ml) ⁼	Ignition after 30 secs	Ignition after 2 mins	Ignition after 5 mins	T-shirt Material [*]
1	12.30	15.42	N	N	N	C
2	6.76	8.47	N	N	N	C
3	6.38	8.00	N	N	N	C
4	8.51	10.67	N	N	N	C
5	8.00	10.03	N	N	N	C
6	8.66	10.85	N	N	N	C
7	7.25	9.09	N	N	N	C
8	6.93	8.69	N	N	N	C
9	5.89	7.38	N	N	N	C
10	9.27	11.62	N	N	N	C
11	6.71	8.41	N	N	N	P/C
12	7.73	9.69	N	N	N	P/C
13	7.40	9.28	N	N	N	P/C
14	9.62	12.06	N	N	N	P/C
15	8.09	10.14	N	N	N	P/C
16	6.56	8.22	N	N	N	P/C
17	7.66	9.60	N	N	N	P/C
18	9.67	12.12	N	N	N	P/C
19	8.68	10.88	N	N	N	P/C
20	7.57	9.49	N	N	N	P/C

⁼Density of MIBK = 0.7978g/ml

^{*}C = 100% Cotton; P/C = 50% Cotton, 50% Polyester

TABLE A6 *The ignition of an operational amount of CS incapacitant spray on a t-shirt when subjected to a taser discharge with no air gap in the circuit.*

A 3.2 CS with 1cm air gap

Spray Number	Reduction in Can Weight (g)	Quantity Sprayed (ml) ⁼	Ignition after 30 secs	Ignition after 2 mins	Ignition after 5 mins	T-shirt Material [*]
1	9.44	11.83	Y	--	--	C
2	6.40	8.02	N	N	N	C
3	7.58	9.50	N	N	N	C
4	8.78	11.01	Y	--	--	C
5	8.00	10.03	N	N	N	C
6	8.64	10.83	Y	--	--	C
7	7.22	9.05	Y	--	--	C
8	7.40	9.28	Y	--	--	C
9	6.97	8.74	Y	--	--	C
10	11.45	14.35	Y	--	--	C
11	7.55	9.46	Y	--	--	P/C
12	7.66	9.60	N	N	N	P/C
13	9.16	11.48	Y	--	--	P/C
14	9.25	11.59	N	N	N	P/C
15	6.96	8.72	Y	--	--	P/C
16	6.72	8.42	N	N	N	P/C
17	7.17	8.99	Y	--	--	P/C
18	5.39	6.76	Y	--	--	P/C
19	7.34	9.20	Y	--	--	P/C
20	11.45	14.35	Y	--	--	P/C

⁼Density of MIBK = 0.7978g/ml

^{*}C = 100% Cotton; P/C = 50% Cotton, 50% Polyester

TABLE A7 *The ignition of an operational amount of CS incapacitant spray on a t-shirt when subjected to a taser discharge with a 1cm air gap in the circuit at the t-shirt.*

A 3.3 PAVA with no air gap

Spray Number	Reduction in Can Weight (g)	Quantity Sprayed (ml) ⁼	Ignition after 30 secs	Ignition after 2 mins	Ignition after 5 mins	T-shirt Material [*]
1	14.22	15.89	N	N	N	C
2	9.11	10.18	N	N	N	C
3	10.90	12.18	N	N	N	C
4	6.30	7.04	N	N	N	C
5	4.15	4.64	N	N	N	C
6	10.70	11.96	N	N	N	C
7	12.28	13.72	N	N	N	C
8	9.60	10.73	N	N	N	C
9	8.05	8.99	N	N	N	C
10	8.01	8.95	N	N	N	C
11	6.67	7.45	N	N	N	P/C
12	8.78	9.81	N	N	N	P/C
13	10.87	12.15	N	N	N	P/C
14	10.33	11.54	N	N	N	P/C
15	8.81	9.84	N	N	N	P/C
16	7.72	8.63	N	N	N	P/C
17	8.73	9.75	N	N	N	P/C
18	10.24	11.44	N	N	N	P/C
19	10.40	11.62	N	N	N	P/C
20	10.03	11.21	N	N	N	P/C

⁼Density of ethanol=0.789g/ml, density of water=1.000g/ml, therefore density of 1:1 mix taken to be 0.895g/ml

^{*}C = 100% Cotton; P/C = 50% Cotton, 50% Polyester

TABLE A8 *The ignition of an operational amount of PAVA incapacitant spray on a t-shirt when subjected to a taser discharge with no air gap in the circuit.*

A 3.4 PAVA with 1cm air gap

Spray Number	Reduction in Can Weight (g)	Quantity Sprayed (ml) ⁼	Ignition after 30 secs	Ignition after 2 mins	Ignition after 5 mins	T-shirt Material [*]
1	11.34	12.67	N	N	N	C
2	10.82	12.09	N	N	N	C
3	11.38	12.72	N	N	N	C
4	8.19	9.15	N	Y	--	C
5	12.70	14.19	N	N	N	C
6	10.11	11.30	N	N	N	C
7	7.71	8.61	N	N	N	C
8	9.81	10.96	N	N	N	C
9	10.92	12.20	Y	--	--	C
10	7.65	8.55	N	N	N	C
11	8.24	9.21	Y	--	--	P/C
12	8.60	9.61	N	N	N	P/C
13	15.42	17.23	N	N	N	P/C
14	7.93	8.86	N	N	N	P/C
15	7.51	8.39	N	N	N	P/C
16	11.23	12.55	N	N	N	P/C
17	10.20	11.40	N	Y	--	P/C
18	8.44	9.43	Y	--	--	P/C
19	9.45	10.56	N	N	N	P/C
20	8.87	9.91	Y	--	--	P/C

⁼Density of ethanol=0.789g/ml, density of water=1.000g/ml, therefore density of 1:1 mix taken to be 0.895g/ml

^{*}C = 100% Cotton; P/C = 50% Cotton, 50% Polyester

TABLE A9 *The ignition of an operational amount of PAVA incapacitant spray on a t-shirt when subjected to a taser discharge with a 1cm air gap in the circuit at the t-shirt.*

B DETAILS FROM THE X26 EVALUATIONS

B 1 Details of the Accuracy Tests

B 1.1 Method

In each test the taser was clamped firmly into a tripod and the device checked with an inclinometer to ensure it was level and upright to within $\pm 0.2^\circ$. A flat cardboard target was secured at a set distance from the taser. With the laser sight turned on, the red dot position was marked on the target with a spot. A cartridge was inserted into the front of the taser and fired at the target.

The M26 accuracy was previously tested using standard 21ft cartridges. As the design of these had changed slightly since the previous testing, the M26 was initially set up at a distance of 20ft (6.1m), as the distance with the greatest spread, to see if the accuracy of the cartridges had significantly changed. The results can be seen in Figure B1

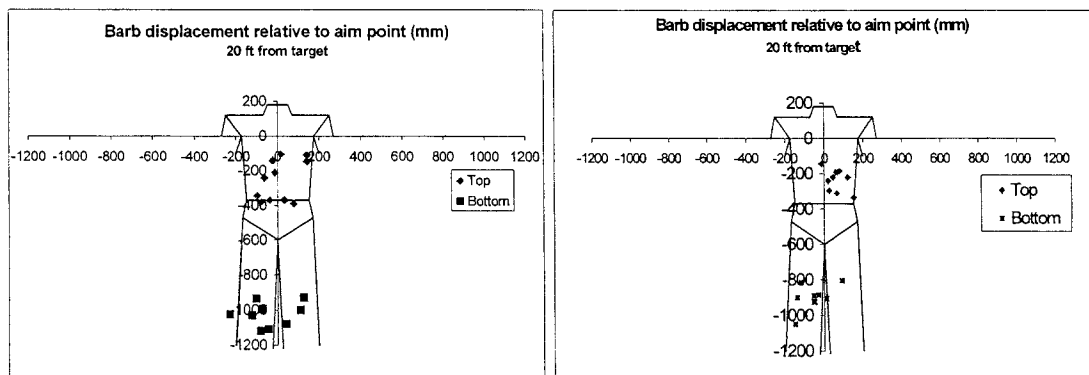


FIGURE B1 (a,b) *Position of standard cartridge taser barbs fired from an M26 taser at 20ft (6.1m) with old cartridges (left) and redesigned cartridges(right)*

There is clearly little difference between the barb spread. If anything, the new cartridge has a slightly tighter spread. However, it was considered that there was not such a difference as to require a repeat of the M26 results.

In October 2004 the standard 21ft cartridges were redesigned again so that the blast doors and rear of the cartridges' "wings" are now silver in colour. The M26 taser was again set up at 20ft (6.1m) to identify any change in accuracy. The results of this can be seen in Figure B2. Again, apart from two errant top barbs there was little or no difference and thus the cartridges used in testing the accuracy of the X26 are valid in the case of these new cartridges.

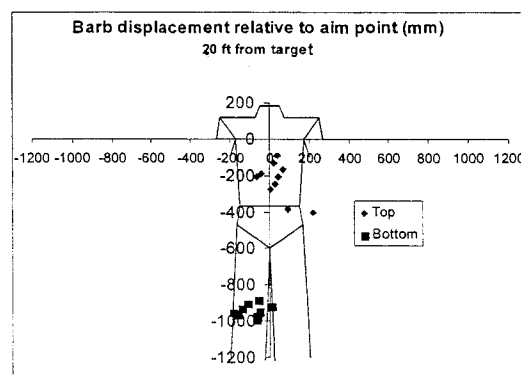


FIGURE B2 *Position of new silver-door standard cartridge taser barbs fired from an M26 taser at 20ft (6.1m))*

Tests were carried out at 5, 10, 15 and 20ft (1.5, 3.0, 4.6 and 6.1m) distances from the target. 10 shots were fired at each of these ranges. The tests were carried out using the Taser International M26 with XP cartridges and the X26 with both standard and XP cartridges. All tests were carried out indoors at room temperature, with no wind effect and with the taser clamped firmly using a tripod, therefore representing an ideal situation.

B 1.2 Results

Figures B3-B6 show the results of accuracy testing at PSDB for the different models and cartridges. The figures show the position of each of the barbs at each distance as they would fit on a man-sized target with the outline showing torso, leg and arm areas. The point of aim is taken as the centre of the chest area just above the nipple line (coordinates 0,0). The figures show the separation between the top barb and the laser sight dot, and the separation between the top and bottom barbs.

The results for the X26 taser with standard cartridges are shown in Figures B3 a-d. It can be seen that the top barb generally strikes around the laser sight, even above it, at distances up to 15ft (4.6m). Beyond that it begins to fall below the sight. However, the bottom barb appears to strike to the left of the top barb, getting further away as the range increases.

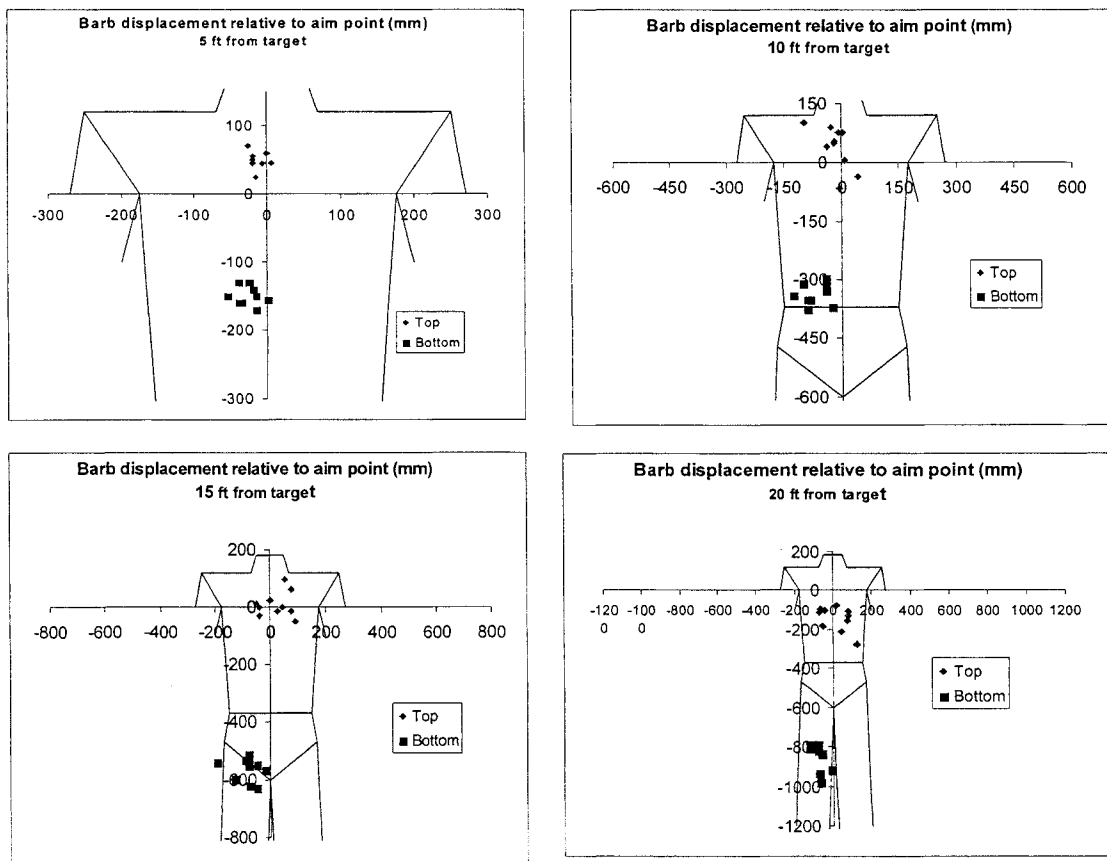


FIGURE B3 (a,b,c,d) *Position of standard cartridge barbs when fired from a Taser International X26 taser at 5ft (1.5m), 10ft (3.0m), 15ft (4.6m) and 20ft (6.1m).*

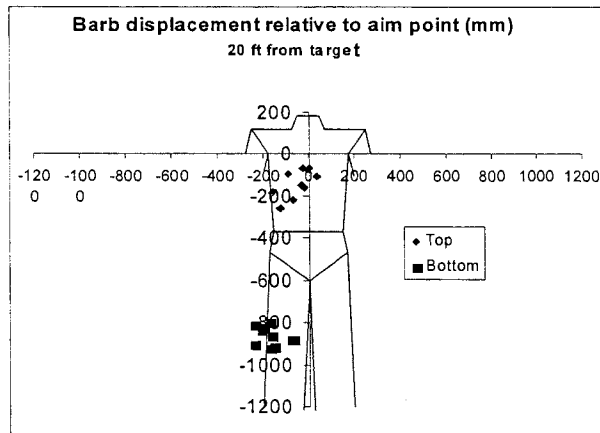


FIGURE B4 *Position of standard cartridge barbs when fired from a different X26 taser at 20ft (6.1m).*

A second X26 was used to obtain the results in Figure B4. This unit showed the same left of centre position of the bottom. This was observed at the handling trials and with XP as well as standard cartridges. This latter observation shows that it is an issue with the X26 unit itself.

During the testing at 20ft (6.1m) one of the wires from the cartridge was too short and the barb did not reach the target.

The results for the X26 taser with XP cartridges are shown in Figures B5 (a-d). The bottom barb again strikes to the left of the top barb. The top barb maintains its accuracy with respect to the sighting laser at up to 10ft (3.0m). However, it can be seen to fall slightly below the laser at 15ft – 20ft (4.6m – 6.1m) and an average of 34cm below at 25ft (7.6m). The barb spread is generally small but is starting to get larger at 25ft. This compares with the top barb of a standard cartridge keeping its accuracy at 15ft (4.6m).

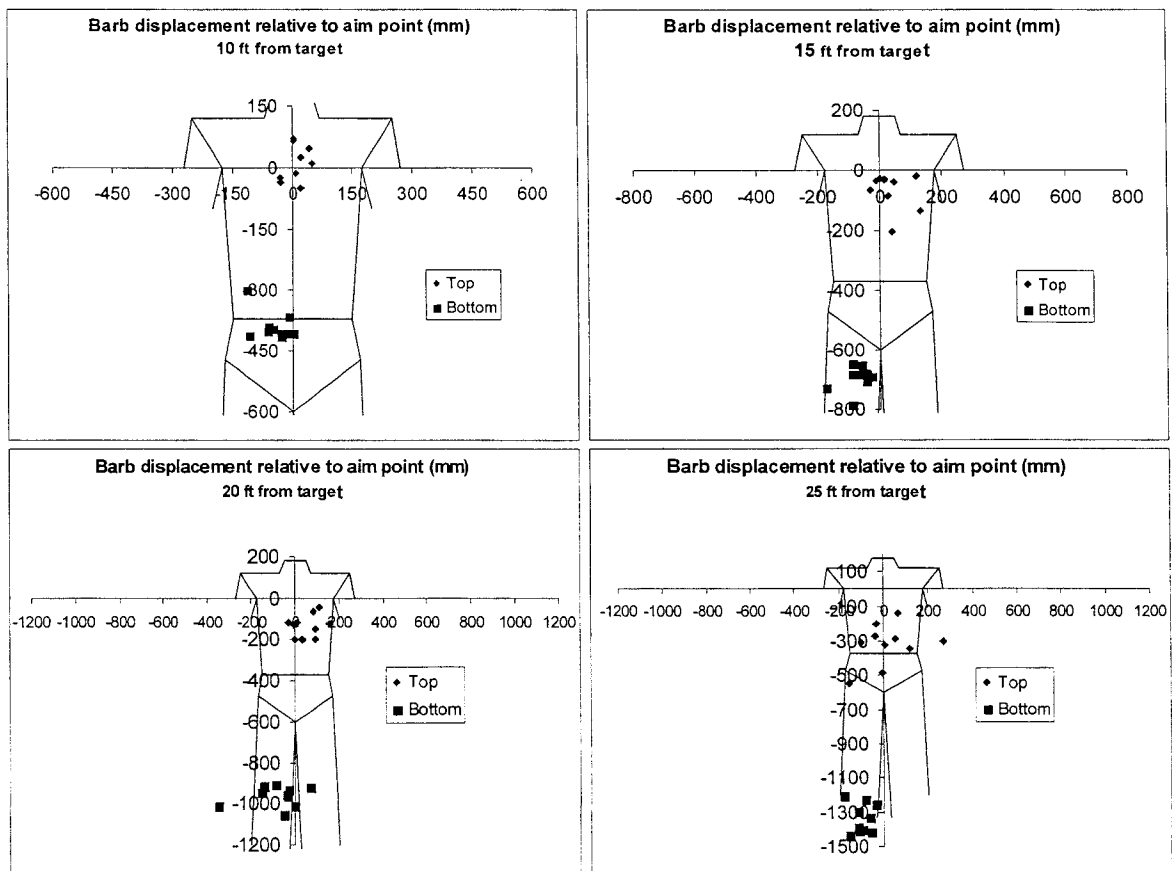


FIGURE B5 (a,b,c,d) *Position of XP cartridge barbs when fired from a Taser International X26 taser at 10ft (3.0m), 15ft (4.6m), 20ft (6.1m) and 25ft (7.6m).*

The results for the M26 taser with XP cartridges are shown in Figures B6 (a-d). Here it can be seen that the bottom barb is striking directly below the top barb. The barb spread is small except for the bottom barb at 25ft (7.6m). Once again the top barb maintains its accuracy with respect to the sighting laser at up to 10ft (3.0m) and can be seen to fall slightly below the laser at 15ft – 20ft (4.6m – 6.1m). At 25ft (7.6m) the top barb spread is smaller than those that were fired from the X26 but the average drop from the laser sight is 43cm greater.

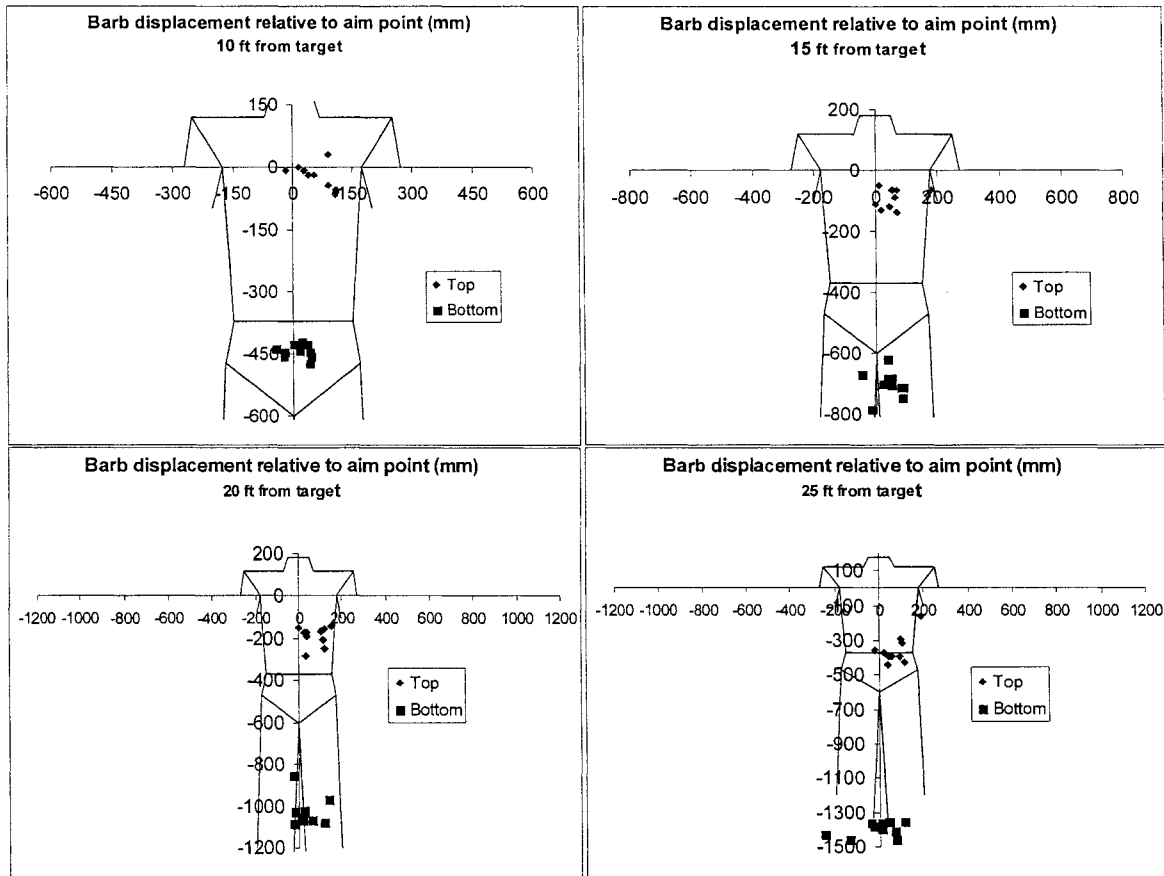


FIGURE B6 (a,b,c,d) *Position of XP cartridge barbs when fired from a Taser International M26 taser at 10ft (3.0m), 15ft (4.6m), 20ft (6.1m) and 25ft (7.6m).*

B 2 Details of the Drop Tests

B 2.1 Method

An X26 taser, with a standard cartridge inserted into the firing bay, was dropped from a height of 2m onto a steel plate. The test was to be repeated ten times using the same taser unless significant damage was evident in which case a second unit would be substituted. The taser was held at different angles (so as to present each planar surface and the four vertical corners of the unit) and had a different cartridge inserted for each drop. Any damage to the taser or cartridges was noted. Following the drop, and for those cartridges still intact, each cartridge was fired from the dropped taser if it was still capable of being fired safely. Any unusual results were recorded. Cartridge testing was carried out previously so the unit itself is the item under test. It was also important to note whether the unit discharged upon impact.

It should be noted that the test units were selected at random from those received by PSDB as a typical production model. It cannot be guaranteed that the units tested were not particularly robust or fragile examples. However, given that the company produces all units to the same specification they should be fairly representative.

B 2.2 Results

The first taser was dropped in four vertical orientations (presenting the bottom, front, top and back of the weapon to the floor). In these tests it suffered no damage other than the badge on the DPM falling off. On these occasions two cartridges were undamaged and two had their blast doors fall off, one of which then failed to function.

On the fifth drop with the right hand side of the weapon towards the floor, the safety switch snapped. As a result the switch on the right hand side of the weapon still controlled the safety function while the one on the left was loose and had no control. The cartridge in this drop suffered no damage.

A replacement taser unit was used for the remainder of the tests. On the sixth drop, with the left-hand side of the weapon towards the floor, the badge came off the new DPM but there was no other visible damage and it fired normally. The blast doors came off the cartridge and some of the wire came out but the cartridge still functioned normally.

In drops seven and eight, in which the front, bottom corner and top, back corner were presented to the floor respectively, the unit suffered no apparent damage, as was the case with the latter cartridge. The former cartridge's blast doors came off and it did not function.

On the ninth drop, where the back bottom corner was lowermost, there was a slight crack in the casing of the battery chamber but this did not affect the functioning of the weapon. In the tenth drop, on the front top corner, there was slight split in the top of the casing. At this point the taser ceased to function even though the DPM was 30% full. However, it returned to normal function with a full DPM inserted. The cartridges in these last two drops suffered no damage.

At no point during the testing did the taser discharge upon impact.

B 3 Details of the Extreme Temperature Tests

B 3.1 Warm Conditions Method

Five X26 units in 'ready to fire' condition (i.e. with charged batteries and a cartridge inserted) were placed in an incubator held at +50°C for 24 hours. A number of spare batteries and cartridges for each taser were also placed in the incubator.

The ready to fire taser was removed from the incubator along with three extra cartridges. The taser was immediately fired if it was functioning and any results noted. If the taser did not fire it was left at room temperature (20°C) for 5 minutes with its cartridge inserted then fired again and the results noted. The process was repeated at regular intervals after the initial removal from the incubator. If there were any problems at any stage with a taser model then the spare components in the incubator were exchanged with ambient temperature components so that each one could be tested for its temperature dependence.

B 3.2 Results at 50°C

The first unit fired normally upon removal from the incubator. After 5 minutes it discharged but missed one or two pulses. At 10 minutes it fired normally. The remaining 4 tasers all fired normally upon removal and after 5 and 10 minutes. In all of the units, the laser dot from the sighting system was slightly enlarged and less bright. They returned to normal after approximately 30 minutes outside the incubator.

B 3.3 Cold Conditions Method

Cold weather testing of the X26 taser was carried out in April 2004 by Lt Tapani Hack of the Police Technical Centre in Finland. It is with his kind permission that the results are reproduced here.

The X26 tasers and cartridges under test were stored in a -20°C environment for a minimum of 15 hours. The tasers were then fired within 5 minutes of their removal from the freezer. After firing two cartridges the taser unit was returned to the freezer for a minimum of 10 minutes. This was carried out for 10 XP cartridges and 24 standard cartridges. The tasers were fired into a target and their strike positions were noted.

B 3.4 Results at -20°C

Stage 1 – Testing with XP cartridges

One or both of the tabs on the sides of the cartridges snapped on 4 out of 10 tests. On these occasions the positions of the barb strikes were considerably lower than they should have been. On another firing the top barb remained stuck in the cartridge. In one instance the taser unit itself failed to activate. When it was switched off and then back on again it then functioned normally. On the remaining 4 shots the weapon functioned normally and the barbs struck the target in expected positions.

Stage 2 – Testing with standard cartridges

The X26 taser unit had version #14 of the dataport software installed so as to try and alleviate the problem identified in Stage 1 where the unit failed to discharge. On all occasions the taser unit itself functioned normally. However, on 11 out of 24 shots one or both barbs remained, jammed in the cartridge. To ensure that this was not a problem with the taser, 6 more cold cartridges were fired from a warm taser and 2 of these also jammed.

C DETAILS FROM THE COMPARISON HANDLING TRIALS

C1 List of Participating Forces

Bedfordshire Police
British Transport Police
Cleveland Police
Durham Constabulary
Essex Police
Hertfordshire Constabulary
Kent Police
Northumbria Constabulary
Surrey Police
Sussex Police
Tayside Police
West Midlands Police

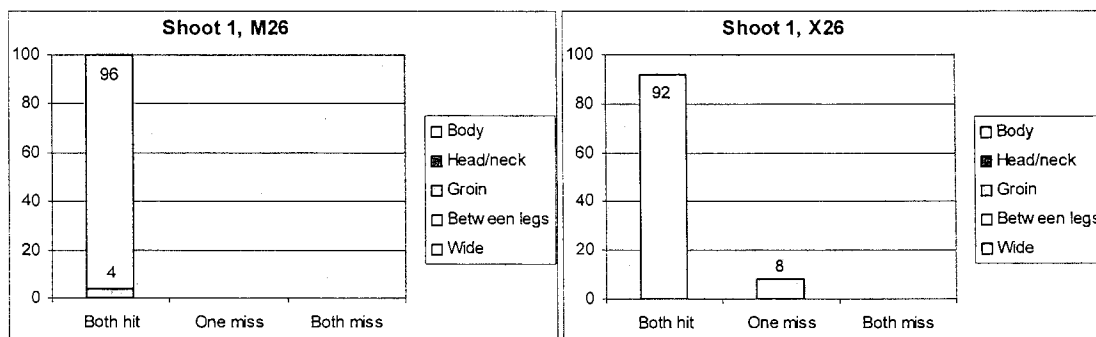
C2 Results for Each Taser Model in Each Exercise

Exercise 1

Purpose: The aim of this exercise was to determine the accuracy of each taser when hand-fired under ideal conditions (standing, motionless target, face-on, single shot) using the laser sights attached to the weapon.

Action: The taser was loaded before raising. On command, the officer raised their taser and fired at a stationary target from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to do this as quickly as possible. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



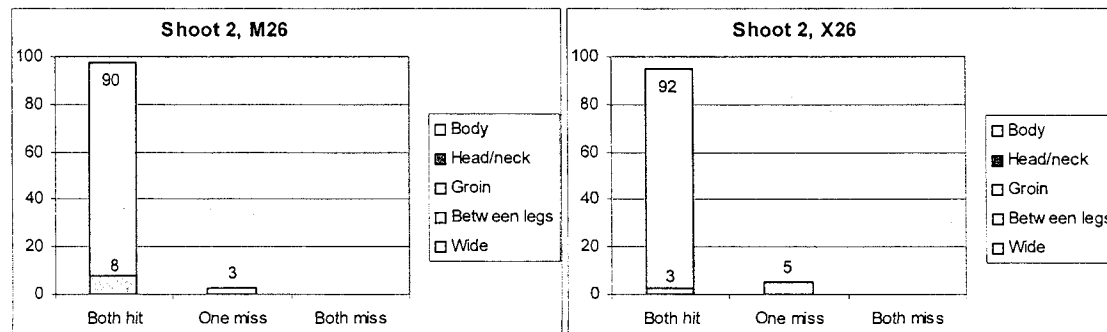
Values in percentages

Exercise 2

Purpose: The aim of this exercise was to determine if the accuracy of each taser was affected when the firer was in a kneeling position.

Action: The officer had their loaded taser drawn already. On command, the officer fired the taser from a kneeling position at a stationary target from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to do this as quickly as possible. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



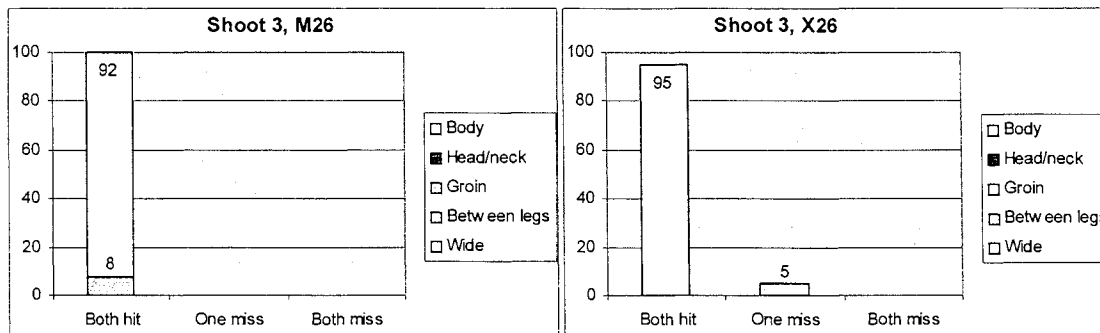
Values in percentages

Exercise 3

Purpose: The aim of this shoot was to determine the accuracy of each taser when hand-fired under low-light conditions, using the laser sights attached to the weapon.

Action: This exercise was carried out with lights dimmed. The taser was loaded before drawing. On command, the officer raised their taser and fired at a stationary target from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to do this as quickly as possible. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



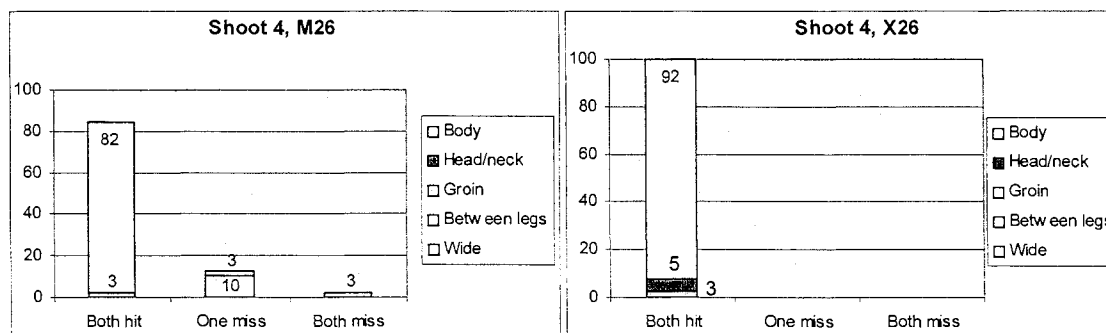
Values in percentages

Exercise 4

Purpose: The aim of this exercise was to determine the accuracy of each taser when fired at a moving target.

Action: This was a mobile target test. A person who was the moving target stepped into a doorway and then stepped out of it again. The taser was drawn, with a cartridge loaded, ready to fire. The target came from a different direction with a random amount of time before his appearance for each shoot. The officer was instructed to fire as quickly as possible from a distance of 13ft (4.0m) using the laser sights on the weapon. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



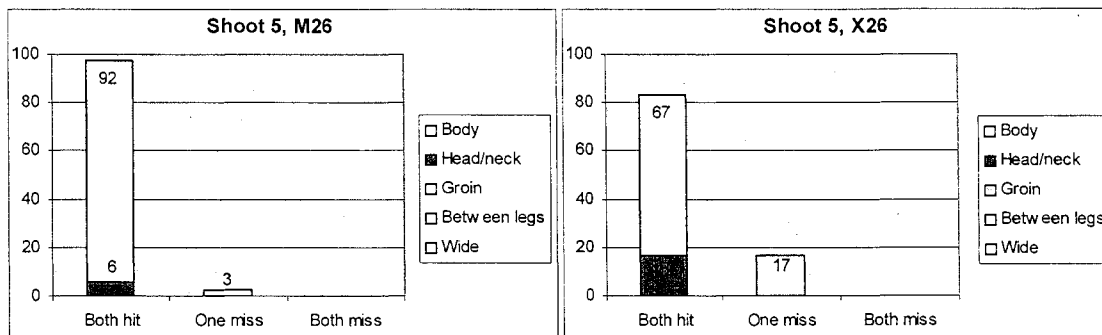
Values in percentages

Exercise 5

Purpose: The aim of this shoot was to determine the accuracy of each taser when hand-fired under ideal conditions, without using the laser sights attached to the weapon.

Action: Taser was loaded before starting. On command, the officer raised their taser and fired at a stationary target from a distance of 13ft (4.0m) without using the laser sights on the weapon. The officer was instructed to do this as quickly as possible. The exercise was repeated 3 times for each model of taser.

Results: 12 officers - each fired 3 shots with each model of taser.



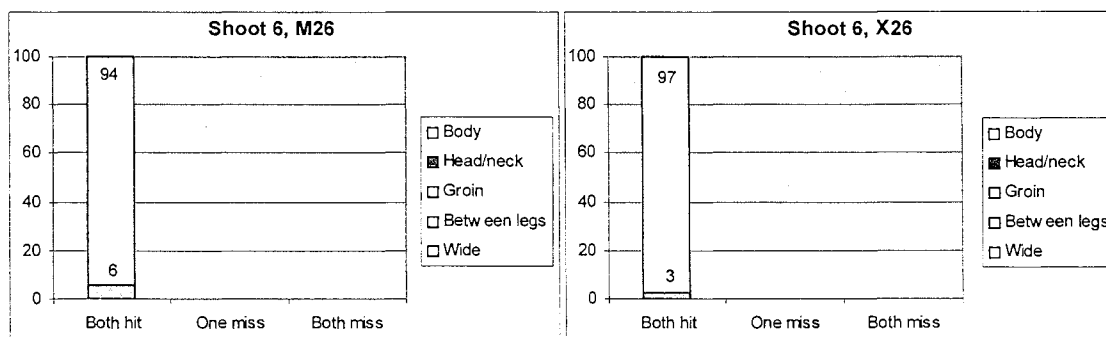
Values in percentages

Exercise 6

Purpose: The aim of this shoot is to determine the accuracy of each taser when the target is advancing towards the officer.

Action: This was a mobile target test. The taser was loaded before starting. The target was initially be at 30ft (9m) from the officer. The officer raised their taser, which was pre-loaded, and activated the laser sights. They then fired as soon as they felt that the target was both in range of the weapon and a threat. As soon as the barbs struck the target he stopped. The exercise was repeated 3 times for each model of taser.

Results: 12 officers - each fired 3 shots with each model of taser.



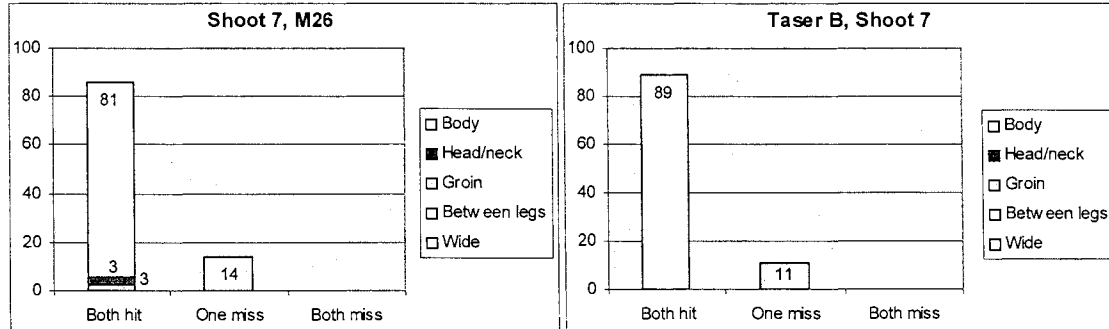
Values in percentages

Exercise 7

Purpose: The aim of this shoot was to determine the accuracy of each taser when hand-fired at a target lying on the floor.

Action: The taser was loaded before raising. On command, the officer raised their taser and fired at a stationary target lying on the floor from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to do this as quickly as possible. The exercise was repeated 3 times for each model of taser.

Results: 12 officers - each fired 3 shots with each model of taser.



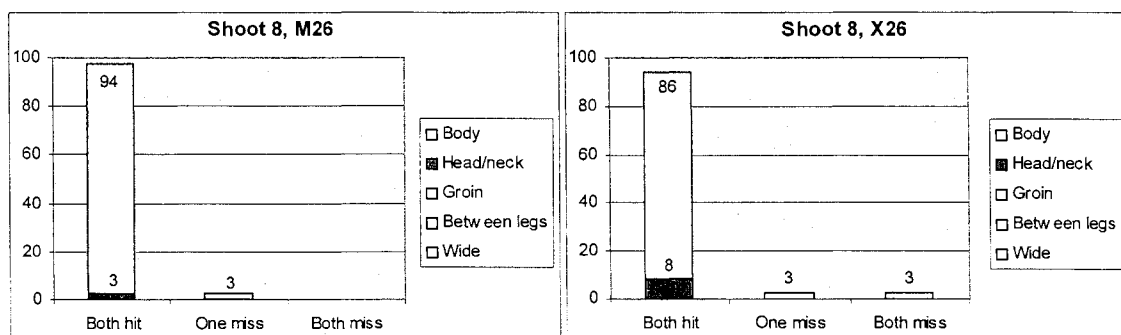
Values in percentages

Exercise 8

Purpose: The aim of this shoot was to determine the accuracy of each taser when hand-fired over a riot shield and mannequin at an upright target.

Action: The taser was loaded before starting and the officer took position behind the mannequin with the taser pointing towards the target over the top of the shield. On command, the officer fired at a stationary target from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to do this as quickly as possible and was not permitted to step from behind the shield. The exercise was repeated 3 times for each model of taser.

Results: 12 officers - each fired 3 shots with each model of taser.



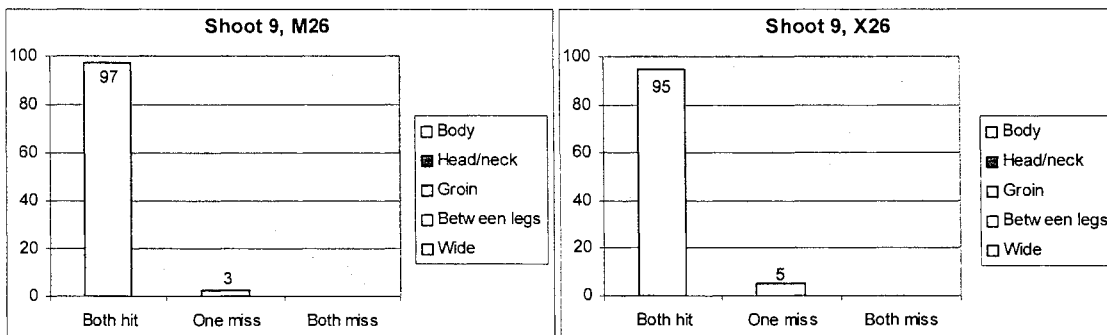
Values in percentages

Exercise 9

Purpose: The aim of this shoot was to compare the loading/reloading characteristics of each taser to assess how this affected the speed at which the taser can be fired at a target when multiple shots are required.

Action: The taser was loaded before starting. On command, the officer fired at a stationary target from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to fire 3 repeat shots at the target as quickly as possible, whilst not compromising their safety. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



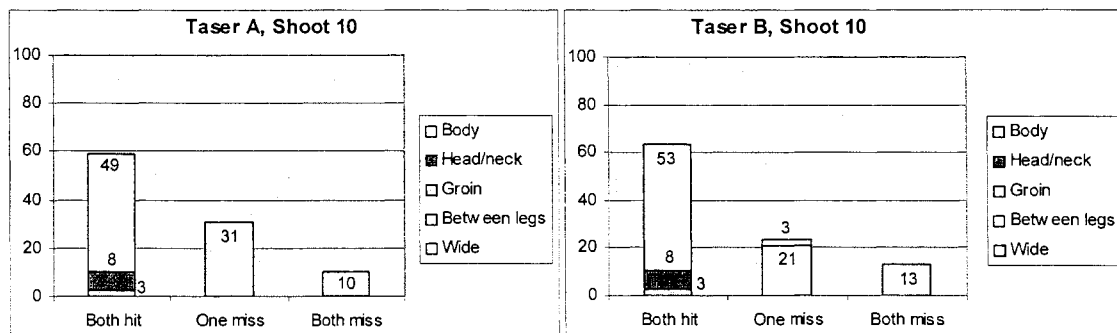
Values in percentages

Exercise 10

Purpose: The aim of this shoot was to determine the accuracy of each taser when hand-fired at a target lying on the floor, without using the laser sights attached to the weapon.

Action: The taser was loaded before raising. On command, the officer raised their taser and fired at a stationary target lying on the floor from a distance of 13ft (4.0m) without using the laser sights on the weapon. The officer was instructed to do this as quickly as possible. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



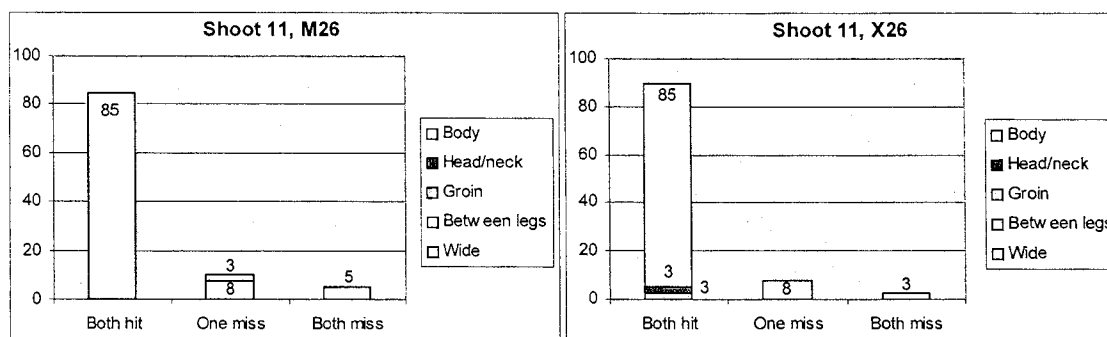
Values in percentages

Exercise 11

Purpose: The aim of this shoot was to determine the accuracy of each taser when hand-fired around a riot shield and mannequin at an upright target.

Action: The taser was loaded before starting and the officer took position behind the mannequin with the taser pointing towards the target around the side of the shield. On command, the officer fired at a stationary target from a distance of 13ft (4.0m) using the laser sights on the weapon. The officer was instructed to do this as quickly as possible and was not permitted to step from behind the shield. The exercise was repeated 3 times for each model of taser.

Results: 13 officers - each fired 3 shots with each model of taser.



Values in percentages

C3 Questionnaire; Questions and Responses

A: M26, B: X26

Q1. The device is accurate and discriminating			Percentages		
	A	B	M26	X26	M26 previous
Strongly Agree	5	15	13	39	74
Tend to Agree	29	20	76	53	26
Tend to Disagree	4	3	11	8	0
Strongly Disagree	0	0	0	0	0
Don't Know	0	0	0	0	0
Q2. The device could be used to target an individual within a group					
	A	B	M26	X26	M26 previous
Strongly Agree	9	12	24	32	56
Tend to Agree	23	22	61	58	33
Tend to Disagree	6	4	16	11	3
Strongly Disagree	0	0	0	0	5
Don't Know	0	0	0	0	3
Q.3 The device could be used effectively against a moving target					
	A	B	M26	X26	M26 previous
Strongly Agree	2	13	5	34	41
Tend to Agree	21	16	55	42	36
Tend to Disagree	12	6	32	16	3
Strongly Disagree	2	2	5	5	2
Don't Know	1	1	3	3	19
Q4. The device is appropriate for use in all officer roles					
	A	B	M26	X26	M26 previous
Strongly Agree	8	12	21	32	30
Tend to Agree	10	12	26	32	21
Tend to Disagree	14	9	37	24	29
Strongly Disagree	6	5	16	13	19
Don't Know	0	0	0	0	2
Q5. The device is easy to point and aim					
	A	B	M26	X26	M26 previous
Strongly Agree	18	29	47	76	88
Tend to Agree	15	7	39	18	11
Tend to Disagree	4	1	11	3	2
Strongly Disagree	1	1	3	3	0
Don't Know	0	0	0	0	0
Q6. The device is easy to load and unload					
	A	B	M26	X26	M26 previous
Strongly Agree	22	26	58	68	66
Tend to Agree	12	12	32	32	33
Tend to Disagree	3	0	8	0	2
Strongly Disagree	1	0	3	0	0
Don't Know	0	0	0	0	0
Q7. The device is easy to operate, including the safety switch and trigger					
	A	B	M26	X26	M26 previous
Strongly Agree	1	23	3	62	75
Tend to Agree	14	12	37	32	22
Tend to Disagree	15	2	39	5	3
Strongly Disagree	8	0	21	0	0
Don't Know	0	0	0	0	0
Q8. The device can be used accurately without the use of laser sights					
	A	B	M26	X26	M26 previous
Strongly Agree	5	3	13	8	35
Tend to Agree	17	20	45	53	26
Tend to Disagree	9	9	24	24	8
Strongly Disagree	4	3	11	8	3
Don't Know	3	3	8	8	27
Q9. The device is safe to use without risk of electric shock to the officer					
	A	B	M26	X26	M26 previous
Strongly Agree	15	15	39	39	44
Tend to Agree	22	22	58	58	52
Tend to Disagree	1	1	3	3	3
Strongly Disagree	0	0	0	0	0
Don't Know	0	0	0	0	2
Q10. The device could be used in confined spaces					
	A	B	M26	X26	M26 previous
Strongly Agree	18	20	47	53	45
Tend to Agree	17	15	45	39	44
Tend to Disagree	1	1	3	3	5
Strongly Disagree	1	1	3	3	2
Don't Know	1	1	3	3	5

Q11. After completion of the exercises, I felt confident in handling and using this device						
	A	B		M26	X26	M26 previous
Strongly Agree	18	31	Strongly Agree	47	82	84
Tend to Agree	14	7	Tend to Agree	37	18	13
Tend to Disagree	6	0	Tend to Disagree	16	0	3
Strongly Disagree	0	0	Strongly Disagree	0	0	0
Don't Know	0	0	Don't Know	0	0	0

Q12. The device fits well in the hand so it can be gripped firmly to facilitate retention in the event of a struggle						
	A	B		M26	X26	M26 previous
Strongly Agree	9	11	Strongly Agree	24	29	75
Tend to Agree	20	16	Tend to Agree	53	42	22
Tend to Disagree	7	7	Tend to Disagree	18	18	0
Strongly Disagree	2	4	Strongly Disagree	5	11	2
Don't Know	0	0	Don't Know	0	0	2

Q13. The grip extension improves the handling of the device					M26	X26
	A	B				
Strongly Agree	3	20	Strongly Agree	8	54	
Tend to Agree	10	13	Tend to Agree	27	35	
Tend to Disagree	19	4	Tend to Disagree	51	11	
Strongly Disagree	2	0	Strongly Disagree	5	0	
Don't Know	3	0	Don't Know	8	0	

Q14. The device would be suitable for use in the dark or subdued lighting conditions						
	A	B		M26	X26	M26 previous
Strongly Agree	6	24	Strongly Agree	16	63	41
Tend to Agree	12	11	Tend to Agree	32	29	31
Tend to Disagree	15	1	Tend to Disagree	39	3	7
Strongly Disagree	4	0	Strongly Disagree	11	0	2
Don't Know	1	2	Don't Know	3	5	20

Q15. The device could not easily be discharged unintentionally						
	A	B		M26	X26	M26 previous
Strongly Agree	7	5	Strongly Agree	18	13	46
Tend to Agree	23	23	Tend to Agree	61	61	40
Tend to Disagree	4	4	Tend to Disagree	11	11	11
Strongly Disagree	0	1	Strongly Disagree	0	3	3
Don't Know	4	5	Don't Know	11	13	2

Q16. The batteries are easy to change						
	A	B		M26	X26	M26 Previous
Strongly Agree	7	18	Strongly Agree	11	28	28
Tend to Agree	21	37	Tend to Agree	33	58	58
Tend to Disagree	13	8	Tend to Disagree	20	13	13
Strongly Disagree	23	1	Strongly Disagree	36	2	2
Don't Know	0	0	Don't Know	0	0	0

Q17. Overall which model did you prefer				M26	X26
				21	79
A	8	B	30		

Q18. Overall which model did you like least				M26	X26
				79	21
A	30	B	8		

D OPERATIONAL REQUIREMENT

ACPO General Policing Committee Police Use of Firearms, Self-defence, Arrest and Restraint and Public Order Sub-committees

"LESS LETHAL OPTIONS - An Operational Requirement "

1 Introduction

- 1.1 The purpose of this paper is to outline an Operational Requirement for 'less lethal options' for the police service in the UK, against which potential options can then be assessed. The requirement is intended to cover a wide range of conflict management scenarios, including those associated with self-defence, arrest and restraint, public disorder and the police use of firearms.
- 1.2 The term 'less lethal options' is employed to include weapons, devices or tactics whose design and intention is to induce compliance without substantial risk of serious or permanent injury or death. In other words, the desired effect is to control and then neutralise a threat without recourse to lethal force. While the actual outcome may occasionally be lethal, this is less likely than the result of the use of firearms, for example.
- 1.3 In situations involving public disorder it should be recognised that the 'threat' to be controlled and neutralised may arise from the collective behaviour of groups of individuals or from individuals within a group. For this reason tactical options should be capable of:
 - ☐ preventing groups forming or re-forming;
 - ☐ dispersing or de-stabilising groups;
 - ☐ containing groups;
 - ☐ maintaining a sterile area or keeping groups at a safe distance;
 - ☐ controlling and neutralising any threat posed by specific individuals within groups.

All the above support the principle tactical approaches outlined in the ACPO Manual of Guidance on Keeping the Peace and the overall intention of managing and minimising risk.
- 1.4 In this manner, it is intended to progress towards the provision of appropriate tactical options in conflict management from a full consideration of their potential use and effect. This consideration is necessary to ensure that the Police Service has the ability to best protect the lives and rights of all involved with policing incidents by the appropriate use of force (officers, subjects and the public in general). The first stage will involve the development of specifications and appropriate tests for equipment to undergo to assess how they meet the Operational Requirements. Further work can then be done to develop the necessary accompanying tactics.
- 1.5 Operational decisions can then be made based on a range of tactical options shown to be effective - a 'capability set'. This will prevent individual forces or officers having to evaluate the effectiveness of a plethora of potential weapons/devices/tactics themselves, and will assist in attaining a consistent and professional approach.
- 1.6 In arriving at the requirements outlined below, consideration has been given to a number of operational scenarios, which should continue to be borne in mind through the necessary deliberations. The discriminating factors arising from such scenarios include the following:
 - ☐ Close quarters threat;
 - ☐ Long Range threat;
 - ☐ Precise / Imprecise Situation;

- ☐ Indoors / Outdoors location;
- ☐ Weapons;
- ☐ Hostage Involvement;
- ☐ Immediacy of threat;
- ☐ Containment requirement;
- ☐ Victim-precipitated killings;
- ☐ 'Special Population' subjects (i.e. those mentally incapacitated by illness, disorder or drugs);
- ☐ Group activity.

2 Operational Requirements

2.1 Accuracy

The option should be discriminating over a range between 1 and 25 metres. This range is chosen as an approximation to that within which a firearms containment can reasonably be provided by officers with handguns, accounting for their general accuracy. In public disorder situations accuracy at range will be particularly important since it may be necessary to target individuals within a tightly packed group. Considerable further benefit will arise if an option is discriminating over a greater distance (e.g. up to 50m), allowing it to be deployed as part of a wider containment, and making it more readily transferable to some public disorder scenarios. Naturally, options that are shown to be effective over only part of this range will still merit consideration.

2.2 Immediacy

The option should be rapidly effective - ideally immediate. Although certain scenarios may benefit from a delayed action, these will be limited.

2.3 Subject Population

The option should be effective against the maximum proportion of the population (taking account of both permanent and transitory differences (e.g. ergonomics / drunkenness)).

2.4 Ease of Operation

The option should be capable of being operated by one officer. It should be suitable for use by the majority of officers with appropriate training, regardless of physical size or gender. It should not rely on complex motor skills

2.5 Judgement

The option should minimise the number of judgement issues arising from its use (i.e. clear intention / targeting / outcome).

2.6 Injury / Lethality

The option should minimise the risk to any person of serious injury and/or lethality at all ranges.

2.7 Effect

The option should at least temporarily neutralise the threat, rendering a subject incapable of carrying out an immediate threat of violence. The duration of such incapacitation must be sufficient to permit officers to safely approach a subject and restrain them, which may include the need to overcome an obstruction (i.e. locked door / barricade).

2.8 Environment

The option should be effective in all operating conditions (e.g. weather, indoors/outdoors, lighting, temperature etc.) and in confined spaces.

- 2.9 Mobility / Flexibility
The option should be effective against a moving target. It should be easily transported to the scene of an incident, and ideally portable at the scene.
- 2.10 Cumulative Effects
The use of the option should not preclude the use of other tactical options before/after. It should not increase or reduce their effects if they are subsequently employed.
- 2.11 Safety / Security
The use of the option, and the equipment required, should be safe to operate and store, and should have the minimum security considerations.
- 2.12 It is naturally recognised that few, if any, options will meet all of the above requirements. They will, nevertheless, enable the production of a matrix to derive the 'best fit' available, probably involving a combination of options. The resulting capability, combined with appropriate tactics and training, should equip officers involved in the widest range of scenarios.

3 Other issues

- 3.1 The following additional issues need to be considered in arriving at this capability set which will have a bearing on the practicality of adopting specific options:
- 3.2 Repeat Operation - speed of multiple use - Are repeated applications of the option likely to be required? How feasible is such repetitive operation (by one officer/several)?
- 3.3 Specialist v. General use - Is the option appropriate for deployment in all officer roles, or only by specialists (e.g. dog-handlers, Tactical Firearms Units, new team)
- 3.4 Training - What are the training periods associated with the option's deployment, both initially and in terms of refresher training? What training facilities are required?
- 3.5 Costs
- 3.6 Legal Implications - Would the adoption of the option require new legal authority (e.g. prohibited weapons)? What are the tactical considerations in the light of Human Rights (e.g. proportionality, least intrusive option)?
- 3.7 Acceptability (Police and public) - What is the external and internal impact assessment associated with the options considered?
- 3.8 Visual effect (on subject / third party) - Does the option involve equipment looking like a firearm? Can the option be carried / used covertly?
- 3.9 After-effects - How long do potential after-effects last? What treatment/training is required to deal with potential after-effects?
- 3.10 Durability - How robust is any equipment required for an option? Over what period can an option be said to be reliable - what checking is required?
- 3.11 Authority required to use - Who should authorise the use of the option? Who should review its use, when, and how often?
- 3.12 Audit Trail – Does the option have a secure system for recording use? Will this enhance a documented system for decision making?

4 Conclusion

- 4.1 The issues involved in the Use of Force can be complex - both the level and its nature need to be justified if we are to show that it was legal, proportional and in pursuit of a legitimate aim. It is hoped that the above Operational Requirement can provide the initial basis to explore the options available. This is with a view to simplifying the decision-making process required in operational situations at the same time as complying with the standards required of a professional Police Service.

E DOMILL SECOND STATEMENT ON THE MEDICAL IMPLICATIONS OF THE USE OF THE M26 ADVANCED TASER (JULY 2004)

DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL)

Second statement on the medical implications of the use of the M26 Advanced Taser (July 2004)

Background

1. The role of the DSAC^{*} Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL) is to provide the Secretary of State for the Home Department and the Secretary of State for Northern Ireland with:
 - a. Advice on the medical implications of generic classes of less-lethal weapon systems (which includes biophysical, pathological and clinical aspects);
 - b. Independent statements on the medical implications of use of specific less-lethal systems, when used according to the formal guidance provided to users;
 - c. Advice on the risk of injury from identified less-lethal systems striking specific areas of the body, in a format that would assist users in making tactical decisions, and developing guidance to users to minimise the risk of injury.
2. On 30 Jan 03, the Home Secretary gave authority to proceed with an operational trial of the M26 Taser as a less-lethal option in incidents at which authority to use firearms had been granted. The M26 Taser would be used by police officers already trained in the use of firearms. The operational trial commenced on 21 Apr 03 for an initial duration of 12 months. Five police forces are taking part in the trial, employing a joint policy, operational guidance and training strategy developed by the Association of Chief Police Officers (ACPO). The police forces funded an independent evaluation of the trial, undertaken by PricewaterhouseCoopers.
3. Prior to the commencement of the trial, DOMILL provided an independent statement on the medical implications of the use of the M26 Taser within the ACPO Policy and the ACPO Operational Guidance[†]. The statement was based primarily on an assessment of the medical risks undertaken on behalf of DOMILL by the Defence Science and Technology Laboratory (Dstl). The statement is an Annex to this document. DOMILL also produced medical advice notes for the subjects on whom the M26 had been used, hospital staff, and General Practitioners. The DOMILL statement concluded that: *"From the available evidence on the use of the device, the risk of life-threatening or serious injuries from the M26 Advanced Taser appears to be very low."*
4. DOMILL recommended that research should be undertaken to clarify the cardiac hazards associated with use of the M26 Taser on individuals who could be considered to have a greater risk of adverse effects. The principal investigations should address the possible cardiac hypersusceptibility to M26 Taser currents arising from drugs commonly used illegally in the UK, acidosis and pre-existing disease, and a more thorough review of the

^{*} Defence Scientific Advisory Council.

[†] DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL). Statement on the medical implications of the use of the M26 Advanced Taser. DSTL/CBS/BTP/PAT-ACPO/MAN/REP/4/ dated 9 Dec 02.

vulnerability of pacemakers and other implanted devices. DOMILL did not consider it *essential* from a medical perspective that the studies be completed before approval was considered for the initial trial of the M26 Taser under the terms of the ACPO Policy and Guidance. DOMILL also requested that the output of the sighting laser of the M26 Taser should be measured and classified according to British Standards.

Extension of the operational trial of the M26 Taser

5. A report on the operational trial has been produced by PricewaterhouseCoopers. The report concluded that use* of the M26 Taser “*helped secure a positive outcome to an incident, minimising the potential need for officers to deploy other, possibly more lethal technologies*”. ACPO has proposed that, subject to a review of the medical assessment and Ministerial support, the trial should be extended: With Chief Officer agreement, the trial should be extended to all forces for use by existing firearms officers, in situations where an authority for firearms would be granted in accordance with criteria presently laid down within the ACPO Manual of Guidance on the Police Use of Firearms.
6. ACPO and the Home Office have requested that DOMILL review the extant medical statement and offer a second statement on the medical implications of use, consequential to:
 - ☐ Revised and reviewed ACPO policy, operational guidance and training;
 - ☐ The outcome of the research to date addressing their recommendations in the extant statement;
 - ☐ The data presented to them by ACPO on the outcome (to date) of the initial trial currently proceeding.

This statement is the outcome of that review.

Review of the research undertaken

Effect of M26 Taser cardiac currents

7. The research requested by DOMILL was undertaken by Biomedical Sciences department of Dstl. Dstl adopted a two-fold experimental approach to clarifying the risks of adverse cardiac effects arising from use of the M26 Taser:
 - a. **Effect of drugs of abuse on cardiac function.** This approach was predicated on empirical observations made in the United States that many of those involved in confrontations in which Taser was used were under the influence of drugs. The hypothesis tested was that the drugs *per se* could predispose an individual to an adverse cardiac event, irrespective of Taser use. Seven drugs of abuse were tested

* “Use” by ACPO’s definition is the: (i) drawing of a device in circumstances where any person perceives the action as a use of force or a threat of use of force; (ii) discharging the barbs at a subject; (iii) application and discharge in “touch stun” mode.

for their ability to modify the electrical properties of cardiac ventricular conduction tissue *in vitro**.

- b. **Direct application of electrical pulses to isolated beating hearts.** The pulses represent the current predicted to flow in the heart during discharge of the M26 Taser. The assessment is designed to investigate the effect of the pulses on heart rhythm, the threshold for any effects observed and the effects of selected drugs of abuse upon this threshold. These studies necessitated the development of novel, complex computer models of the interaction of M26 Taser pulses with the human body, in order to predict the shape and magnitude of current flowing in the heart.
8. **Effect of drugs of abuse on cardiac function.** Seven recreational drugs, or their active metabolites, were examined in the sheep isolated cardiac Purkinje fibre preparation. MDMA (Ecstasy) and phencyclidine (PCP) produced effects on the action potential suggestive of an increased risk of development of *torsades de pointes* arrhythmia. Although cocaine, cocaethylene (a psychoactive metabolite formed when cocaine and alcohol are concurrently abused) and (+)-methamphetamine did not induce action potential prolongation, a critical review of the scientific and clinical literature revealed that these drugs still have the potential to compromise cardiovascular function in a way that could precipitate a life-threatening cardiac event. The clinical literature suggested that morphine (the principal metabolite of heroin) and Δ 9-tetrahydrocannabinol (the principal psychoactive component of cannabis) are likely to be relatively benign in terms of cardiovascular toxicity at doses likely to be employed by abusers.
9. The results from the study, together with evidence gleaned from the literature, suggest that some frequently abused drugs have the potential to contribute to any cardiac-related morbidity or mortality that may arise in the context of Taser use. Furthermore, it seems reasonable to assume that this conclusion could be generalised to other emotionally charged and possibly violent confrontations with law enforcement personnel.
10. The adverse cardiac effects produced by any individual drug are likely to be dependent on several risk factors, including dose consumed, co-use with other drugs (including pharmaceutical drugs and ethanol) and pre-existing heart disease. This complex interplay of multiple risk factors could conceivably contribute to any cardiac-related morbidity or mortality associated with Taser use against drug-intoxicated persons. Officers should be aware that the risk of any adverse response in the aftermath of Taser deployment may be higher in drug-impaired individuals and, accordingly, they should be vigilant of any unusual behaviour displayed by the apprehended person that may signal the need for early medical intervention.
11. DOMILL has reviewed the paragraph in its first statement that discussed pro-arrhythmic factors (paragraph A28 in the Annex) and concludes that it does not require modification on the basis of the current work. The current work provides experimental evidence to support the original statement.
12. **Direct application of electrical pulses to isolated beating hearts.** The complex mathematical modelling underpinning the second experimental approach has never been undertaken before and has challenged the limits of current knowledge. Early setbacks with the modelling have been overcome and the quantitative modelling of the M26 Taser

* The assay addressed the effect of drugs on the cardiac action potential (the electrical basis for cardiac conduction, contraction and relaxation) in sheep isolated Purkinje fibres. Prolongation of the action potential duration is thought to be a possible marker for a potentially lethal type of ventricular arrhythmia known as *torsades de pointes*.

current flow in the heart will be completed shortly. This will enable the studies on the isolated beating heart to commence.

Vulnerability of pacemakers and other implantable electronic devices

13. The implanted devices examined in the review included cardiac pacemakers, cardioverter defibrillators, cochlear implants and other implantable neurostimulatory devices, such as phrenic and vagal nerve stimulators. Published material on the construction of the devices was consulted to assess the likely consequences of Taser barb impact on the device. An assessment of available published information on the observed interaction of external electromagnetic fields with active implantable devices was also undertaken. The review also addressed the probability of a person wearing an active implantable device being present in a situation where a Taser may be deployed and used; this drew upon a comparison of the age profiles of the frequency of use of pacemaker and implantable cardioverter defibrillator wearers in the UK, and data on the age profile of persons arrested by the police.
14. It was concluded that the probability of direct impact and physical damage to implanted electronic devices was very low. The effects of M26 Taser electrical fields on the function of cardiac pacemakers are unlikely to be permanent. The limited number of studies that have been reported on devices similar to Tasers indicate that effects are likely to be limited to reversion to asynchronous pacing mode, and that these effects are temporary. The effects of Taser output on implantable cardioverter defibrillators are likely to be similar to those on cardiac pacemakers. The nature of the cardiac rhythm sampling process indicates that application of a Taser for a period of 5 seconds is unlikely to result in inappropriate therapy delivery. The effect of Taser outputs on other active implantable devices, such as cochlear implants and nerve stimulators, has not been reported. The interaction with nerve stimulators could produce deleterious effects but the risk of such interaction occurring is low, and it is unlikely that the effects will be long-term or life-threatening.
15. The age profile of cardiac pacemaker recipients is significantly different from the overall population and that of persons arrested in situations where a Taser may be deployed. The probability of an individual wearing a pacemaker being present in such a situation is therefore likely to be considerably lower than the overall incidence of pacemakers in the population.
16. It is concluded that there is no requirement to undertake experimental studies on the vulnerability of active implantable medical devices to the output of the M26 Taser.

Ocular hazard of the laser sight

17. The output of the sighting laser has been tested and is a Class 3R according to the British Standard BS EN 60825-1. Class 3R exceeds the internationally agreed maximum permissible exposure values, but due to the safety factors in these values, devices of this Class are unlikely to cause ocular injuries for accidental exposures. Intentional viewing or deliberate exposure of the eyes of a subject must be avoided.

Overall conclusion

18. The risk of life-threatening or serious injuries from the M26 Taser is very low.

Recommendations

19. DOMILL reaffirms its view that it does not consider it essential from a medical perspective that the experimental studies are completed before approval is considered for the extension of the M26 Taser trial under the terms of the ACPO Guidance. This DOMILL statement will be reviewed when the results of the study on the isolated beating heart are available.
20. The studies by Dstl on the effects of drugs on isolated Purkinje fibres should be published in the medical press.
21. Six months after the commencement of the extended operational trial, the Home Office should provide DOMILL with a report outlining the circumstances of every use of the M26 Taser, the post-incident medical assessments undertaken by the FME, and the clinical consequences noted by the FME or clinical staff. DOMILL should be advised as soon as practical of any primary or secondary injury that could be classed as life-threatening, unexpected, or potentially leading to disability.
22. DOMILL should be advised of any changes in:
 - a. the specification or performance of the M26 Taser;
 - b. the guidance to users, and training practices;
 - c. the policy and practice of deployment, use and audit.

[signed]

Chairman, DSAC Sub-committee on the Medical Implications of Less-lethal Weapons.

**Annex: First DOMILL statement on the medical implications of the use of the M26
Advanced Taser (December 2002)**

Background

- A1. The role of the DSAC* Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL) is to provide the Secretary of State for the Home Department and the Secretary of State for Northern Ireland with:
- a. Advice on the medical implications of generic classes of less-lethal (LL) weapon systems (which includes biophysical, pathological and clinical aspects);
 - b. Independent statements on the medical implications of use of specific LL systems, when used according to the formal guidance provided to users;
 - c. Advice on the risk of injury from identified LL systems striking specific areas of the body, in a format that would assist users in making tactical decisions, and developing guidance to users to minimise the risk of injury.
- A2. This advice is in support of the UK Government's requirements arising from:
- a. Recommendations 69 and 70 of the Patten report into policing in Northern Ireland†: (i) a research programme to find an acceptable, effective and less potentially lethal alternative to the Baton Round, (ii) provision of a broader range of public-order equipment to the police;
 - b. The desire of the Association of Chief Police Officers (ACPO) to have a wider range of options in conflict management scenarios, including those most commonly associated with self-defence and restraint, and the police use of firearms.

In summer 2000, the Secretary of State for Northern Ireland set up a UK-wide inter-departmental Steering Group to co-ordinate a programme to address both requirements.

- A3. The report of the Steering Group on Phase 2 of the programme described the various classes of LL weapon systems being evaluated to address the requirements‡. The report categorises the technologies according to the requirement for research and evaluation. Within Category A (devices which may be subject to research and evaluation immediately) are electrical incapacitation devices, specifically Tasers.

Evaluation of Tasers

- A4. Tasers are hand-held devices that propel two barbs at an individual. The barbs are intended to attach to the skin or clothing on the torso and/or lower limbs. A sequence of very short

* Defence Scientific Advisory Council.

† Report of the Independent Commission on Policing in Northern Ireland; September 1999.

‡ Patten Report Recommendation 69 and 70 Relating to Public-Order Equipment – A research programme into alternative policing approaches towards the management of conflict. Second Report of the Steering Group; November 2001. www.nio.gov.uk/policing.htm.

duration high voltage current pulses passes through wires connecting the device to the barbs. The current flows into the body and results in a loss of muscular control and in pain. Some models also enable direct contact of the Taser hand-set to the surface of an individual; two closely spaced fixed electrodes pass the current pulses into the subject. This manner of application is usually classed as use in “stun” or “probe” mode; pain is the principal local physiological effect.

- A5. The Police Scientific Development Branch of the Home Office has undertaken an evaluation of a number of commercially available Taser devices. The evaluation addressed barb accuracy and dispersion, the measurement of electrical output and reliability, a review of manufacturers’ claims and handling characteristics in a number of test scenarios. DOMILL also undertook a general review of the medical implications of the use of Tasers.
- A6. On the basis of the objective technical and medical evaluations, and the policy underpinning the development of a broader range of options for conflict management in the UK, ACPO has proposed that an operational trial of the M26 Advanced Taser should take place. DOMILL was invited to provide this current statement for Ministers on the medical implications of the use of the M26 Advanced Taser in an operational trial.

Guidance on use by police of the M26 Advanced Taser

- A7. The policy and practice defining the training for use, deployment and operational use of a weapon system is central to an assessment of the medical implications of that use. The ACPO Guidance states that an operational trial would be limited to firearms officers in selected police forces. The M26 Advanced Taser would provide firearms officers with additional means of dealing with threats of violence in which conventional firearms and other less-lethal tactical options may be deployed. Such options include batons, sprays of sensory incapacitant, and “empty hand” physical restraint.
- A8. Deployment and use of the Taser would conform to the principles of guidance already laid down in the ACPO Manual of Guidance on Police Use of Firearms. The trial would be subjected to critical and independent review.

Technical approach for the assessment of medical implications of use

- A9. The milestones placed upon DOMILL by the Steering Group dictated the nature of the technical approach: a wide-ranging review of literature and preliminary analytical studies on the biophysical interaction of Taser current pulses with the body. On behalf of DOMILL, the Defence Science and Technology Laboratory (Dstl) undertook a comprehensive review of information publicly available, and provided by manufacturers and police forces in North America. Over 800 references were acquired and reviewed. The review encompassed:
 - a. basic neurophysiological science to consider the mechanism of the interaction with excitable tissues;
 - b. peer-reviewed scientific and medical papers specifically addressing laboratory and operational use of Tasers and stun weapons: electrical output, risks to personnel, analyses of medical issues observed in hospital facilities in individuals subjected to Tasers, and the circumstances surrounding the deaths of personnel subjected to Tasers in the course of their arrest;

- c. evidence on the risks provided by manufacturers: scientific, medical, use on volunteers and records of operational use;
- d. the basis of the application of electrical safety standards and criteria to Taser outputs;
- e. newspaper reports of Taser use and complications arising from use;
- f. surveys of effectiveness and injuries observed and recorded by law enforcement agencies in the United States and Canada;
- g. peer-reviewed papers on the hazardous effects of electric fields on physiology.

The review by Dstl was conducted by cardiac and nerve electrophysiologists, physicists and engineers specialising in the interaction of electrical energy with the body, and trauma specialists.

- A10. Dstl also undertook computer-based modelling of the interaction of Taser pulses with the body. The primary purpose was to assess qualitatively the distribution of currents from Tasers in the body, and to determine semi-quantitatively the changes in current magnitude and distribution for different barb separations and Taser outputs.
- A11. DOMILL endorsed Dstl's approach and reviewed the substantial body of information compiled by Dstl. This statement is based on these data.

Classification of Taser outputs

- A12. Tasers have been classed by users as "low-power" (5-7 Watt) or "high-power" (14-26 Watt). Tasers have been in use for over 20 years, principally in the US. Over most of this period, only low-power Tasers were available, deployed and used. High-power Tasers have been available and in use on volunteers and operationally for about two years; the M26 Advanced Taser is classed as high-power. Assessments undertaken by the PSDB showed that the principal differences in measured output between low- and high-power Tasers were the pulse repetition rate and pulse duration; differences in peak current and voltage between devices were also noted. Dstl modelling studies showed that the magnetic field strength in the body (an index of current) was greater with the high-power Tasers.

The evidence of hazard and risk from the M26 Advanced Taser

- A13. The body of manufacturers' experimental evidence from biological models of the hazardous and intended effects of Taser on excitable tissues is not substantial, particularly with regard to the M26; the peer-reviewed evidence is even more limited. The epidemiological evidence to assess the hazards associated with use of the M26 Advanced Taser is not as robust as that for the low-power models. However, the manufacturer's database of over 1600 operational uses of the M26 and reports from law enforcement agencies in North America did offer some insight into the risks and nature of injuries.

Classification of injuries

A14. Unintended adverse effects from the use of Tasers may be classed thus:

- ☐ Primary: immediate or delayed consequences of electrophysiological phenomena resulting directly from the current flow in the body; it is surmised from the known effects of electric fields and currents on the body (for example, lightning, electric fence controllers) that the organ of principal concern is the heart;
- ☐ Secondary: physical trauma directly associated with Taser use, principally injuries from the barbs and falls; the head is the principal area at risk;
- ☐ Coincidental: injuries received in the incident not directly related to Taser use e.g. baton use, self-inflicted wounds, gun-shot wounds.

It is notable that in two surveys from law-enforcement agencies in North America, more than half of the number of people confronted with the M26 Advanced Taser were impaired by alcohol, drugs or mental illness. Some drugs and metabolic consequences of muscular activity are believed to increase the susceptibility of the heart to potentially life-threatening disturbances of rhythm (arrhythmias).

Conclusions

- A15. On the basis of the evidence, the following conclusions are offered on the medical implications of the use of the M26 Advanced Taser in an operational trial that may be undertaken within the terms of the ACPO Guidance provided to DOMILL.
- A16. **Deaths:** Over the period of use of low-power Tasers, there have been a small number of deaths associated with a large number of operational uses. One paper discusses 16 deaths over a 4 year period in Los Angeles*. Other factors such as pre-existing heart disease and drug use were implicated in these reported deaths. On the available evidence, DOMILL considers it extremely unlikely that a death from primary injuries has been caused by a low-power Taser.
- A17. With regard to the high-power M26 Advanced Taser, the risk of death from primary injury is low and in common with low-power Tasers, is certainly very much lower than that from conventional firearms. Deaths have been reported to be associated with (but not necessarily caused directly by) use of the M26. DOMILL is not aware of any deaths from primary injuries with this weapon, in both operational and volunteer use in North America.
- A18. The confidence of the opinion of a very low risk of death from future use of the M26 is not as high as that for the low-power devices. This uncertainty arises from the smaller numbers of historical operational uses, and the dearth of information on the potentially adverse electrophysiological effects of the higher current flow in the body, particularly in subjects who may have a predisposition to cardiac arrhythmias arising from drug use, pre-existing heart disease or genetic factors.

* Kornblum RH, Reedy SK (1991). Effects of the Taser in fatalities involving police confrontation. *J Forensic Sci.* Vol 36, 434-448. For a rebuttal of some of the conclusions of this paper, see Allen TB (1992). Discussion of "Effects of the Taser in fatalities involving police confrontation". Letter to Editor. *J Forensic Sci.* Vol 37, 956-958.

- A19. DOMILL is not aware of any deaths arising from the secondary consequences of Taser use.
- A20. **Life-threatening and serious injuries:** The risk of life-threatening injuries and of other serious injuries such as the loss of an eye, is considered to be very low. The intuitive high risk of serious head injury from an uncontrolled collapse is not manifested in practice; most subjects apparently collapse in a semi-controlled manner.
- A21. The probability of impact of a barb on the surface of the eye is considered to be low. The impact of barbs on the head has occurred operationally; non-operational evaluation trials on targets have also resulted in head impacts. On the basis of trial data, it is probable that by employing the ACPO Guidance, fewer than 1% of upper barb impacts will hit the head. In the worst case of frontal application, the eyes are a small proportion of the presented area of the head.
- A22. The PSDB has shown in trials that the Taser may cause combustion of flammable solvents on the subject's clothing. This may result in serious burns to the torso and head; the Guidance to Users must highlight and control the risk from flammable liquids such as petrol on the subject.
- A23. **Other effects:** Falls may result in abrasions, scratches, minor lacerations, swellings and areas of redness on the skin. Minor secondary trauma from the penetration of the skin by the barbs will occur; there is sufficient experience from North America to effect simple removal by UK medical professionals.
- A24. Some of the barb penetrations will exhibit small circular burns; areas of skin where current has entered the body from barbs retained in clothing may also exhibit burns. These burns are likely to resolve within a few days, without complications and the need for medical intervention.
- A25. DOMILL is not aware of any evidence that the Taser would induce an epileptic seizure.
- A26. The M26 Taser has a US laser classification that indicates that it is potentially hazardous for *intrabeam* viewing of its sighting laser. The classification according to British Standards and the potential to cause injury must be determined.
- A27. **Use on drug and cardiac-impaired individuals:** It is believed that drugs such as cocaine and pre-existing heart disease may lower the threshold for cardiac arrhythmias. Many of the 16 fatalities associated with use of the low-power Tasers in the Los Angeles survey had also taken PCP (phencyclidine) prior to the incident. PCP is also thought to be pro-arrhythmogenic but is infrequently encountered as a substance of abuse in the UK.
- A28. There is no experimental evidence that the aforementioned pro-arrhythmic factors increase the susceptibility of the heart to low- or high-power Tasers specifically, sufficient to cause an arrhythmic event. Nevertheless, there is sufficient indication from the forensic data and the known electrophysiological characteristics of the heart (and the effects of certain drugs on this) to express a view that excited, intoxicated individuals or those with pre-existing heart disease could be more prone to adverse effects from the M26 Taser, compared to unimpaired individuals. The ACPO Guidance to Users reflects this view.

- A29. **Overall:** From the available evidence on the use of the device, the risk of life-threatening or serious injuries from the M26 Advanced Taser appears to be very low.

Recommendations

- A30. Research should be undertaken to clarify the cardiac hazards associated with use of the Taser on individuals who could be considered to have a greater risk of adverse effects. The principal investigations should address:

- a. Accurate, quantitative estimates of the magnitude of the magnetic and electric field strengths from the M26 in potentially vulnerable parts of the body; this would require enhancement of the preliminary model developed by Dstl. These data will focus the investigations in (b) and (c) below;
- b. Possible hypersusceptibility to Taser currents arising from drugs commonly abused in the UK, acidosis and pre-existing disease; *in vitro* tissue models are available that could be used to address these issues;
- c. The vulnerability of pacemakers and other implanted devices; this issue requires a more thorough review. Experimental studies to assess electromagnetic incompatibility issues are currently not warranted and should await the outcome of the review;

DOMILL does not consider it *essential* from a medical perspective that these studies are completed before approval is considered for the M26 Advanced Taser trial under the terms of the ACPO Guidance.

- A31. The output of the sighting laser of the M26 Taser should be measured, classified according to British Standards and operated to reduce the risk from the ocular hazard.
- A32. Forensic Medical Examiners (FME) and appropriate clinical staff in the principal hospitals within the areas of the police forces participating in the trial should be briefed on the nature of the M26 Advanced Taser, clinical and operational experience from North America, and the presumed and known risk factors. Additionally, it is recommended that a paper be prepared addressing these issues and the wider policy underpinning use, for submission to an appropriate clinical journal.
- A33. At the end of any operational trial (or 6 months after commencement, whichever is earlier), the Home Office should provide DOMILL with a report outlining the circumstances of every use of the M26 Advanced Taser, the post-incident medical assessments undertaken by the FME, and the clinical consequences noted by the FME or clinical staff. DOMILL should be advised as soon as practical of any primary or secondary injury that could be classed as life-threatening, unexpected, or potentially leading to disability.
- A34. DOMILL should inspect the M26 Training Programme Manual to advise on the specific medical risk factors declared in the document.
- A35. DOMILL should be advised of any changes in:

- d. the specification or performance of the M26 Advanced Taser;
- e. the guidance to users, and training practices;
- f. the policy and practice of deployment, use and audit.

[signed]

Chairman, DSAC Sub-committee on the Medical Implications of Less-lethal Weapons

F DOMILL STATEMENT ON THE COMPARATIVE MEDICAL IMPLICATIONS OF THE USE OF THE X26 TASER AND THE M26 ADVANCED TASER

DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL).

Statement on the comparative medical implications of use of the X26 Taser and the M26 Advanced Taser.

Background

1. This statement has been produced by the Defence Scientific Advisory Council (DSAC) sub-committee on the Medical Implications of Less-Lethal Weapons (DOMILL). It provides an independent view for the UK Government on the medical implications of the use of the X26 Taser in the UK, within the policy and guidance of the Association of Chief Police Officers (ACPO). Specifically, this statement compares the predicted principal medical risks associated with the X26 Taser, and the M26 Advanced Taser (referred to subsequently as the M26).
2. On 30th January 2003, the Home Secretary gave authority to proceed with an operational trial of the M26 as a less-lethal option in incidents at which authority to use firearms had been granted. The M26 would be used by police officers already trained in the use of firearms. The operational trial commenced on 21st April 2003 for an initial duration of 12 months. Five police forces took part in the trial, employing a joint policy, operational guidance and training strategy developed by ACPO.
3. Prior to the start of the trial, DOMILL provided an independent statement on the medical implications of the use of the M26 within the ACPO Policy and ACPO Operational Guidance*. The statement was based primarily on an assessment of the medical risks undertaken on behalf of DOMILL by the Defence Science and Technology Laboratory (Dstl). The DOMILL statement concluded that: *"From the available evidence on the use of the device, the risk of life-threatening or serious injuries from the M26 Advanced Taser appears to be very low."*
4. DOMILL recommended that research be undertaken to clarify the cardiac hazards associated with use of the M26 on individuals who could be considered to be at greater risk of adverse effects. The main thrust of the investigations addressed the possible cardiac hypersusceptibility to M26 currents arising from drugs commonly used illegally in the UK and a review of the vulnerability of pacemakers and other implanted devices.
5. A report on the operational trial of the M26 was produced by PricewaterhouseCoopers. The report concluded that use[†] of the M26 *"helped secure a positive outcome to an incident, minimising the potential need for officers to deploy other, possibly more lethal technologies"*. ACPO proposed that, subject to a review of the medical assessment and Ministerial approval, the trial should be extended: With Chief Officer agreement, the trial should be extended to all forces for use by existing firearms officers, in situations where an authority for firearms would be granted in accordance with criteria presently laid down within the ACPO Manual of Guidance on the Police Use of Firearms.

* DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL). Statement on the medical implications of the use of the M26 Advanced Taser. DSTL/CBS/BTP/PAT-ACPO/MAN/REP/4/ dated 9 Dec 02.

[†] "Use" by ACPO's definition is the: (i) drawing of a device in circumstances where any person perceives the action as a use of force or a threat of use of force; (ii) discharging the darts at a subject; (iii) application and discharge in "touch stun" mode.

6. Consequently, DOMILL issued a second statement* subsequent to a review of:
- ☐ revised and reviewed ACPO policy, operational guidance and training;
 - ☐ the outcome of the research addressing the recommendations in their first statement;
 - ☐ the data presented to them by ACPO on the outcome (to date) of the initial trial then proceeding.

The second statement also concluded that: *“The risk of life-threatening or serious injuries from the M26 Taser is very low”*.

7. On the basis of the second DOMILL statement and other evidence, the Home Secretary agreed to ACPO’s proposal and the Parliamentary Under Secretary of State at the Home Office (Caroline Flint MP) announced the decision to Parliament in a Written Answer on 15th September 2004. The Home Secretary’s decision applies only to the M26 Advanced Taser.
8. In May 2003, the manufacturers of the M26 introduced another Taser weapon - the X26. ACPO expressed the view that the X26 may have operational benefits over the M26 and requested that the Police Scientific Development Branch (PSDB) conduct a handling trial with users on the X26, similar to the trial undertaken on the M26 before its introduction. Subsequent to the X26 handling trial, in which the X26 showed some potential operational benefits, the Home Office requested that DOMILL prepares this statement on the medical implications of the use of the X26.

Comparison of M26 and X26 Taser outputs

9. The manufacturers claim that the direct incapacitating effect of the X26 is 5% greater than that of the M26[†]. They claim that the X26 is 60% smaller, 60% lighter and consumes one fifth of the power. The electrical pulses from the two weapons have a different shape, magnitude and pulse repetition frequency. The X26 pulse has a lower peak voltage and a longer duration than the M26; it also has a lower pulse repetition frequency.
10. The evidence from the electro-physiological literature is that the threshold for stimulation of excitable tissues reduces as pulse duration is extended, and as the number of pulses is increased[‡]. Although the implied reduction in peak current for the X26 would suggest a lower risk of adverse cardiac events from currents that may flow in the heart, the extended duration may offset some of that benefit. Because of the complex shape of the Taser waveforms, the overall effect of this trade-off cannot be assessed from the literature, which has been developed using simple waveforms such as rectangular or sinusoidal pulses.

Technical approach to compare risks from X26 and M26

11. DOMILL requested that Dstl undertake the following modelling and experimental work:

* DSAC Sub-committee on the Medical Implications of Less-lethal Weapons (DOMILL). Second statement on the medical implications of the use of the M26 Advanced Taser (July 2004). DSTL/CBS/BTP/PAT-ACPO/MAN/REP/4/ dated 27 Jul 04.

[†] Taser International Inc. use a rating scale entitled “Muscular Disruption Units”. The M26 is used as the baseline of 100 units. The X26 has 105 units. The rationale and method for determining these values is not stated, but is believed to have been based upon the Taser-induced contractile force in the muscles of a pig limb.

[‡] Reilly JP. Applied Bioelectricity: From Electrical Stimulation to Electropathology. Springer - Verlag, 1998, ISBN 0-387-98407-0. Chapter 6 – Cardiac sensitivity to electrical stimulation. Pages 220-225.

- a. Characterisation and comparison of the electrical output of the X26 and M26 Tasers (in conjunction with PSDB).
- b. A comparison of the currents predicted to flow in the human heart from the M26 and X26 Tasers. This would require the use of a computer model of electromagnetic interactions of applied Taser pulses with the superficial tissues of the body, and the flow of currents to the heart.
- c. Application of the predicted currents to isolated, spontaneously beating hearts to establish the threshold for any potentially adverse effects on cardiac rhythm.

Additionally, DOMILL requested a review of : (i) experimental work undertaken by, or on behalf of the manufacturers to support the introduction of the X26; (ii) operational and training data compiled by the manufacturers and global police forces; (iii) medical assessments undertaken by organisations and individuals unconnected with the manufacturers.

Review of the modelling and experimental work undertaken by Dstl

Prediction of Taser currents in the human heart.

12. Computational electromagnetic modelling of M26 and X26 Taser currents flowing in the human heart was achieved using a digital mannequin of the human body, in which the electrical properties of human tissues were represented.
13. Studies on the effect of dart separation on the predicted current density (mA/mm^2) flowing in the heart from the M26 showed that a vertical separation of 225 mm, with the upper dart overlying the heart, gave the maximum cardiac current of the scenarios modelled*. In this most severe scenario, about 20% of the applied current from the M26 was predicted to pass through the heart during the M26's $2\frac{1}{2}$ cycle, 50 μs pulse. The peak predicted current density was about $0.66 \text{ mA}/\text{mm}^2$. With regard to the X26, initially about 10% of the applied current from the X26 was predicted to pass through the heart, rising to about 20%. During the X26's 4 cycle, 160 μs pulse, the peak current predicted was about[†] $-0.11 \text{ mA}/\text{mm}^2$.
14. Thus, the model predicted that the peak current density flowing in the human heart from the X26 pulse was about one sixth that of the M26. The current duration of the X26 in the heart was about 3-4 times that of the M26.

Effects of the predicted Taser currents on cardiac rhythm.

15. **Method:** Excised, spontaneously beating guinea-pig hearts (the Langendorff preparation) were used to determine if the predicted M26 and X26 waveforms in human heart could induce either or both of two phenomena:
 - ☐ Ventricular ectopic beats (VEBs) – cardiac contractions outwith the normal inherent rhythmicity of the heart;
 - ☐ Ventricular fibrillation (VF) – chaotic, asynchronous contractions of the heart muscle fibres that result in no effective heart output. If uncorrected, this would lead rapidly to death in the human.

* The dart separations modelled were those determined in M26 user trials undertaken by PSDB.

† The minus term indicates that this was flowing out of the heart (measured at the peak of the second half cycle).

16. The modelled cardiac M26 and X26 Taser waveforms were applied to the ventricular outer surface of the isolated hearts. Both the absolute values of the peak currents predicted from the modelling, and higher magnitudes, were applied to determine the thresholds for the two phenomena. Rectangular pulses were also applied to hearts to determine the relationship between current density and pulse duration for a well-characterised, simple waveform, and to ensure that the heart preparations were capable of eliciting VEBs or VF.
17. **VEB induction:** When applied during the most vulnerable phase of the heart's electrical cycle (the T-wave of the electrocardiogram) at peak current densities predicted in the human heart during Taser discharge, neither the simulated M26 nor X26 waveforms evoked VEBs. However, VEBs could be elicited by both Taser waveforms by increasing the peak current density of the applied waveforms above those predicted to arise in the human heart. The threshold current density for generation of VEBs for both the M26 and X26 Taser waveforms was greater than 60-fold the modelled current density predicted to occur at the heart, implying a wide safety margin for this particular type of potentially pro-arrhythmic response.
18. **Ventricular fibrillation:** In an attempt to evoke ventricular fibrillation, trains of simulated M26 or X26 Taser waveforms (designed to mimic the discharge patterns of the respective Taser devices) were applied to the ventricular muscle. When the simulated waveforms were applied in this way, neither the M26 nor X26 waveforms elicited ventricular fibrillation at peak current densities up to the maximum output available from the laboratory electrical stimulation system. The threshold peak current density for generation of ventricular fibrillation for the simulated M26 waveform was greater than 70-fold the modelled current density predicted to occur at the heart during Taser discharge. In the case of the simulated X26 waveform, the threshold peak current density was greater than 240-fold the modelled current density. That this failure of the simulated M26 and X26 Taser waveforms to induce ventricular fibrillation was not a function of the biological test system was demonstrated in each experiment by the generation of VF using the rectangular stimulation pulses.
19. **Conclusions:** The results show that the simulated M26 and X26 waveforms, *when amplified*, are capable of eliciting VEBs, but not VF, when applied to the ventricular muscle of spontaneously beating guinea-pig isolated hearts. The guinea-pig heart is more susceptible than hearts of larger animals (e.g. dog, calf and pig, and presumably human) to VF induced by extrinsic electrical stimulation^{*}. The present findings provide indirect evidence for a wide margin of safety in relation to induction of this type of lethal arrhythmia in man. A broadly similar conclusion was reached in a study in the US, in which trains of simulated X26 waveforms of varying intensity, applied across the thorax of anaesthetised pigs, induced ventricular fibrillation only at intensities 15- to 42-fold that of the standard X26 waveform[†].
20. On the basis of the present study, it is considered unlikely that the electrical discharge from the M26 and X26 Taser devices will influence cardiac rhythmicity by a direct action on the heart of healthy individuals.
21. **Contributing factors to cardiac susceptibility:** The possibility that other factors, such as illicit drug intoxication, alcohol abuse, pre-existing heart disease and cardioactive therapeutic drugs may modify the threshold for generation of cardiac arrhythmias cannot be excluded. Similarly, other indirect responses to Taser deployment (e.g. arrhythmias precipitated by stress- or exercise-induced catecholamine release) may, in themselves, predispose to an adverse cardiac outcome independently of the primary (electrical) action of the Taser devices.

^{*} Ferris et al. (1936). Effect of electric shock on the heart. *Electrical Engineering* **55**: 498-515.

[†] McDaniel et. al. (2005). Cardiac safety of neuromuscular incapacitating defensive devices. *Pacing Clin Electrophysiol* **28**(S1): S284-S287.

22. DOMILL's first statement on the M26 Advanced Taser concluded that (paragraph 28):

"There is no experimental evidence that the aforementioned pro-arrhythmic factors increase the susceptibility of the heart to low- or high-power Tasers specifically, sufficient to cause an arrhythmic event. Nevertheless, there is sufficient indication from the forensic data and the known electro-physiological characteristics of the heart (and the effects of certain drugs on this) to express a view that excited, intoxicated individuals or those with pre-existing heart disease could be more prone to adverse effects from the M26 Taser, compared to unimpaired individuals. The ACPO Guidance to Users reflects this view."

Experimental work reported in DOMILL's second statement on the effects of drugs on cardiac function supported this view. The view expressed above is also applicable to the X26 Taser.

Falls to the ground

23. The claim that the X26 is more effective than the M26 in stimulating skeletal muscle implies that falls following X26 application may be less controlled. This will increase the risk of head injury. It is anticipated therefore that there may be a greater likelihood of head contact with surfaces following use of the X26. Overall, the risk of serious head injury is considered to be low.

Overall conclusion

24. The risk of a life-threatening event arising from the direct interaction of the currents of the X26 Taser with the heart, is less than the already low risk of such an event from the M26 Advanced Taser.

Recommendations

25. The Home Office should continue to provide DOMILL with reports outlining the circumstances of every use of the M26, the post-incident medical assessments undertaken by the Forensic Medical Examiner (FME), and the clinical consequences noted by the FME or clinical staff. This audit should include the X26 Taser if this system is made available for use. DOMILL should be advised as soon as practical of any primary or secondary injury that could be classed as life-threatening, unexpected, or potentially leading to disability.

26. DOMILL should be advised of any changes in:

- a. the specification or performance of the M26 and X26 Taser devices;
- b. the guidance to users and training practices;
- c. the policy and practice of deployment, use and audit.

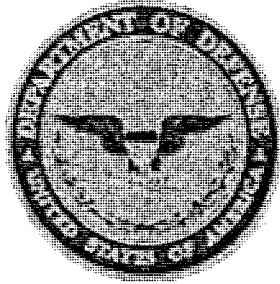
[signed]

Chairman, DSAC Sub-committee on the Medical Implications of Less-lethal Weapons.

G GLOSSARY OF TERMS

Term	Meaning
AACDU	Action Against Crime and Disorder Unit
ACPO	Association of Chief Police Officers
AFID	Anti- Felon Identification
Apnoea monitor	Baby respiration monitoring device that sounds an alarm if the baby stops breathing.
Automatic External Defibrillator (AED)	An apparatus that monitors the heart of the patient and then automatically administers a controlled electric shock to the chest to restore normal heart rhythm if it becomes necessary.
CID	Central Information Display, on the back of a Taser X26
CS	O-chlorobenzylidene malononitrile
Defibrillator	Apparatus that administers a controlled electric shock to the chest to restore normal heart rhythm
Dialysis machine	Apparatus for separating components of a liquid mixture by way of a semipermeable membrane. Primarily used as an artificial kidney.
DOMILL	DSAC Sub-committee on the Medical Implications of Less Lethal Weapons
DPM	Digital Power Magazine – battery system for the X26 taser
Drive-stun mode	The electrical contacts on the hand-held unit are pressed directly onto the subject. However, as the electrodes are only around 50mm apart, this mode of use is unlikely to provide the same incapacitation effect as when used with the cartridge.
DSAC	Defence Scientific Advisory Council
Dstl	Defence Science and Technology Laboratory
ECG monitor	ECG stands for Electrocardiogram, which is a recording of the electrical activity of the heart. An ECG monitor is the machine that measures and records this information.
External pacemaker	Like an ordinary pacemaker, a device that produces and maintains a normal heart rate by producing electrical signals. The external one can be used without implantation.
Hertz (Hz)	Unit representing cycles per second
HMIC	Her Majesty's Inspectorate of Constabulary
Incubator	A container designed to keep premature babies in controlled conditions.
Infusion devices	Term covering syringe pumps and volumetric pumps
M26	Taser International Inc. M26 Advanced Taser
MDA	Medical Devices Agency
MIBK	Methyl isobutyl ketone
MPE	Maximum Permissible Exposure
mW	Milliwatts, a measurement of power. 1/1000 th of a watt.
NiMH	Nickel metal hydride (battery type)
NIO	Northern Ireland Office

NRPB	National Radiological Protection Board
OR	Operational Requirement
PAVA	Pelargonic Acid Vanillylamide
POPCU	Public Order and Police Co-operation Unit
PSDB	Police Scientific Development Branch
Pulse oximeter	An instrument for measuring the pulse and the proportion of oxygenated haemoglobin in the blood.
PUoF	Police Use of Firearms working group
SDAR	Self Defence and Restraint working group
Syringe pump	Like a Volumetric Pump but usually for drugs. Whereas the volumetric pump works by controlling the flow of liquid from a bag suspended above the patient, the syringe pump has a large syringe (piston in a tight-fitting tube). It can be used to give specific doses.
TASER	Acronym from the children's story book "Thomas A Swift's Electric Rifle"
USB	Universal Serial Bus – a type of computer interface connection
Ventilator	A device that controls the flow of air into and out of the lungs of someone who is unable to breathe unaided.
Volts per metre (Vm^{-1})	Unit of measurement for electric field
Volumetric pump	A pump for the facilitation of the slow injection of a substance (e.g. water, electrolytes, blood products and drugs) into the body – usually via a vein. It works by controlling the flow of liquid from a bag suspended above the patient.
W	Watt, a measurement of power..
X26	The Taser International Inc. Taser X26
XPDM	Extended Digital Power Magazine – X26 battery with grip extension to accommodate a second cartridge



**UNITED STATES
DEPARTMENT OF DEFENSE**

**HUMAN EFFECTS CENTER OF
EXCELLENCE**

Report on

**HUMAN EFFECTIVENESS AND RISK
CHARACTERIZATION OF
ELECTROMUSCULAR INCAPACITATION DEVICES**

October 18, 2004

HUMAN EFFECTIVENESS AND RISK CHARACTERIZATION OF ELECTROMUSCULAR INCAPACITATION DEVICES

Report Summary

The Human Effects Center of Excellence (HECOE), established by the Air Force Research Laboratory and the Joint Non-Lethal Weapons Program (JNLWP), conducted a Human Effectiveness and Risk Characterization (HERC) for Electromuscular Incapacitation (EMI) devices.¹ Evaluated devices included the TASER® M26 (primarily) and X26 (to a lesser extent), in which electrical current is carried to the subject via two tethered darts.² Such devices are designed to induce involuntary muscle contractions causing the subject to be temporarily incapacitated. The restricted release report³ of the HERC provides safety and efficacy information, as well as identifies data gaps, on TASER M26 and X26 effects to support the JNLWP and Services in their decision-making processes regarding the employment and further development of EMI devices.

The HERC process is consistent with the National Academy of Sciences and the Society for Risk Analysis recommendations and standards. Three workshops were conducted as part of the HERC process. The first, a data-sharing workshop, identified possible sources of relevant data and determined any insufficiencies in effectively evaluating EMI devices. The second, a peer consultation workshop, outlined potential data gaps, identified additional sources of data, and provided feedback on preliminary strategies for completing dose-response and exposure assessments. At the third workshop, an Independent External Review Panel (IERP) submitted comments and recommendations that were incorporated into the formal HERC document. A final proposed draft was then reviewed by the JNLWD, the sponsoring program manager, HECOE and the IERP. The product of these three workshops, resultant taskings, and final draft feedback is the HERC.

The HERC process presents a characterization of the likelihood of intended and unintended effects from the use of the TASER M26 and X26. Overall, the results indicate that the use of the TASER M26 and X26, as intended, will generally be effective in inducing the desired temporarily incapacitating effect without presenting a significant risk of unintended severe effects. Although likely to be uncommon, some severe unintended effects might occur. In some cases, key data gaps and uncertainties preclude the development of effectiveness and risk probabilities. These overall conclusions regarding effectiveness and risk are consistent with current experienced use of the TASER M26 and X26 in the field, limited empirical data, as well as human effects or safety assessments developed by others. Furthermore, an additional aspect of the analysis is consideration of the comparative risk. Analyses provided by law

¹ Electromuscular incapacitation (EMI) is the generic term used to describe the intended physiological effect from use of these devices. Similarly, an EMI device is generically used to describe devices that produce EMI. Electromuscular disruption (EMD) is the TASER International coined term for the effect and is used to refer specifically to TASER International data and products.

² TASER is a registered trademark, and M26 and X26 are trademarks, of TASER International, Inc.

³ This report summary is releasable to the public. The full HERC report and its appendices, upon which this summary is based, are releasable to U. S. Government agencies and their contractors only. An expanded summary of the report will be published in the near future in the open literature.

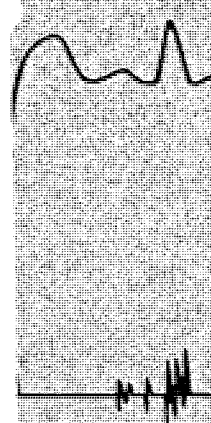
enforcement agencies indicate that increased use of the TASER M26 or the TASER X26 has decreased the overall injury rate of both police officers and suspects in conflict situations when compared to alternatives along the use-of-force continuum.

The occurrence of in-custody deaths has been reported in conjunction with use of TASER devices. However, there are several arguments against any predominant role of EMI in arrest-related deaths. In previous epidemiological reports, deaths were often attributed to illicit drug intoxication in suspects. Although these reports address incidents involving EMI waveforms different from those of the M26 and X26, drug intoxication has been associated with in-custody deaths under a number of circumstances, regardless of how the subjects were subdued. Contemporary medical opinion supports the view that the drug intoxication itself causes or predisposes one to underlying vulnerability. Based on the documentation and research reviewed, this report concludes that EMI is likely not the primary causative factor in reported fatalities. It does recommend further research on EMI exposure in sensitive populations and EMI-drug interactions.

Information developed in the dose-response and exposure assessment was integrated to provide quantitative or qualitative estimates of effect and risk probabilities. The likelihood of various effects when used as intended can be summarized as follows:

- Complete EMD – 80% to 56% (decreasing with distance)
- Partial EMD – 6% to 4% (decreasing with distance)
- Eye strikes – 0.01% to 0.04% (possibly increasing with distance)
- Fall injuries – 0.15% to 0.10% (decreasing with distance)
- Seizure – 0.7% is the upper theoretical bound estimate based on head strike probabilities and a worst-case assumption that all head strikes in the region of the brain result in an electrical exposure that exceeds the seizure threshold. No seizure incidents have been reported.
- Ventricular Fibrillation (VF) is not expected to occur in otherwise healthy adult populations, although data are too limited to evaluate probabilities for potentially sensitive populations or for alternative patterns of exposure. No cases of VF have been reported in training or field exposure conditions.
- TASER exposures induce other effects of minimal severity (e.g., dart-localized burns or lacerations) when successfully employed. These effects are of minimal severity and not further analyzed.
- Some effects of potential concern are too uncertain or lacked sufficient data to develop probability estimates.

The IERP concluded that despite the dramatic nature of the neuromuscular response, application of this conducted energy weapon for temporary incapacitation does not appear to pose significant risk to the recipients. The Panel added that future research will be useful in increasing confidence in extrapolating the risk assessment findings to a more heterogeneous population with uniquely sensitive members.



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Cardiac Safety of Neuromuscular Incapacitating Defensive Devices

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McDANIEL, W.C., ET AL.: Cardiac Safety of Neuromuscular Incapacitating Defensive Devices. *Neuromuscular incapacitation (NMI) devices discharge a pulsed dose of electrical energy to cause muscle contraction and pain. Field data suggest electrical NMI devices present an extremely low risk of injury. One risk of delivering electricity to a human is the induction of ventricular fibrillation (VF). We hypothesized that inducing VF would require a significantly greater NMI discharge than a discharge output by fielded devices. The cardiac safety of NMI discharges was studied in nine pigs weighing 60 ± 28 kg. The minimum fibrillating level was defined as the lowest discharge that induced VF at least once, the maximum safe level was defined as the highest discharge which could be applied five times without VF induction, and the VF threshold was defined as their average. A safety index was defined as the ratio of the VF threshold to the standard discharge level output by fielded NMI devices. A VF induction protocol was applied to each pig to estimate the VF threshold and safety index. The safety index for stored charge ranged from 15X to 42X as weight increased from 30 to 117 kg ($P < 0.001$). Discharge levels above standard discharge and weight were independently significant for predicting VF inducibility. The safety index for an NMI discharge was significantly and positively associated with weight. Discharge levels for standard electrical NMI devices have an extremely low probability of inducing VF. (PACE 2005; 28:S284-S287)*

neuromuscular incapacitation, ventricular fibrillation, electrical safety

Introduction

Neuromuscular incapacitation (NMI) devices discharge electrical energy at high peak voltage, low average current, in 10–100 μ s pulses delivered in 10–19 per-second trains.¹ Parameters for the electrical discharge of NMI devices have been empirically determined to maximize neuromuscular stimulation, cause pain and muscle contractions, and temporarily incapacitate a human subject.²

TASER® (Taser International, Scottsdale, AZ) is an electrical NMI defensive device which has been widely tested.^{3–7} There has been no report directly related to its risk of inducing ventricular fibrillation (VF), although preliminary findings suggest that the likelihood of inducing VF by an NMI discharge is extremely low.^{2,8,9} We hypothesized that the induction of VF would require significantly greater discharge levels than delivered by electrical NMI devices fielded by law enforcement agencies.

Methods

Study Design

The cardiac safety of the electrical discharge by NMI devices was studied in a prospective controlled trial design with the standard NMI discharge as control, compared with discharges that induced VF in a large pig. The animals were anesthetized with isoflurane, their arterial blood pressure, oxygen saturation, respiration, and heart rate were continuously monitored until sacrifice.

Experimental Device and Electrodes

A custom device was built to deliver an NMI electrical discharge that matched the waveform characteristics of the commercially available TASER®, model X26 device. The experimental device allows the output capacitance to vary as a multiple of the nominal capacitance (and charge) for a standard NMI device (0.008 μ F, Fig. 1). All experimental NMI discharges were delivered with a fixed voltage of 6000 V. The waveform, as a short-electrical pulse, was delivered at a repetition rate of 19 pulses per second for 5 seconds. The standard NMI stored charge for the experiment control was (0.008 μ F $\times$ 6,000 V) = 48 μ C. The standard NMI discharge represented the same amount of charge (coulombs) delivered by fielded NMI devices. The pulses were discharged across the thorax of the animal, using metallic barbs that matched darts deployed in fielded NMI devices. One pulse delivery

Partial funding received from the Office of Naval Research, contract N00014-02-C-0059.

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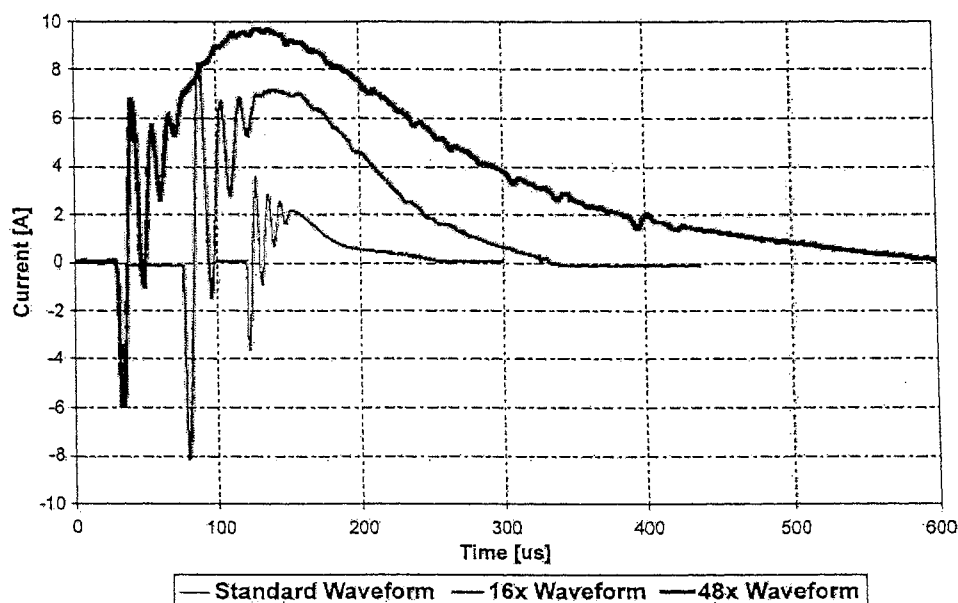


Figure 1. Experimental NMI waveforms compared to waveforms discharged by standard NMI devices (standard waveform, black). Experimental waveforms are shown for 16 times standard discharge (μA , green) and for 48 times standard discharge (μA , red). The waveforms represented a single pulse of a two-stage capacitor discharge; standard NMI devices apply 19 pulses per second for 5 seconds. The two-stage incapacitation discharge was designed to first penetrate high impedance barriers (AC-like portion of waveform) and then to incapacitate neurological and muscular activity (pedestal portion of waveform).

probe was placed at the sternal notch and another on the anterolateral thorax at the point of maximum impulse.

Threshold Procedure

NMI discharges were applied in an up-down method to determine a threshold for VF induction, beginning with a standard NMI discharge. Increasing stored charges were applied to the animal until VF was induced. The stored charge was increased in steps by increasing the size of the experimental NMI device capacitor. Each stepped stored charge had a capacitor value equal to a multiple of the standard capacitance unit ($0.008 \mu\text{F}$), using an increasing number of charge multiples (2 and multiples of 4 from 4 to 48). Following the first VF induction, a decreasing series of capacitance-stepped discharges were then applied until VF was no longer induced by five discharges of equal stored charge. The animals were defibrillated with an automatic external defibrillator. A recovery period of at least 90 seconds was allowed after discharges that did not induce VF. If a discharge did induce VF, a recovery period of at least 5 min was allowed following defibrillation.

Study Endpoints and Safety Index

The primary study endpoint was the determination of a safety index for each animal based on its

weight. Discharge data were collected during the experiment for each NMI discharge applied during the VF threshold procedure. Minimum fibrillating discharge level determined by the VF threshold procedure was defined as the lowest discharge that induced VF at least once; maximum safe level was defined as the highest discharge which could be applied five times without induction of VF; VF threshold was defined as their average. The safety index was defined as the ratio of the VF threshold to the standard NMI discharge ($48 \mu\text{C}$).

Statistical Analysis

All continuous variables are expressed as mean $\pm$ standard deviation. Two sample *t*-tests for samples with equal variance were used to compare mean values. For all comparisons, a $P \leq 0.05$ was considered statistically significant.

Institutional Review

The study protocol received approval from the Institutional Animal Care and Use Committee of Sinclair Research Farms. All animals received humane care.

Results

Nine experiments were completed. The average weight of the swine was $60 \pm 28 \text{ kg}$, ranging from 30 to 117 kg. All animals remained

Blood Pressure Chart

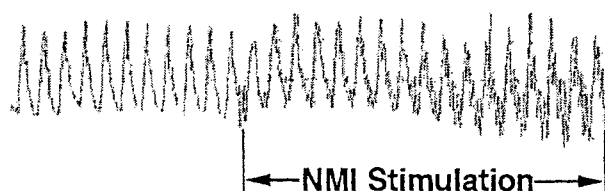


Figure 2. Example of blood pressure before and during an NMI discharge.

hemodynamically stable throughout the experimental procedures, despite an average of 26 ± 12 NMI discharges per animal (Fig. 2).

The safety index for stored charge ranged from 15X to 42X as weight increased from 30 to 117 kg ($P < 0.001$, Table I, Fig. 3). The VF induction threshold level ($1339 \pm 463 \mu\text{C}$ stored charge) was significantly higher than the standard level for applied charge ($48 \mu\text{C}$ stored charge, $P < 0.0001$). The charge multiple at the VF induction threshold was 28 ± 10 compared to the standard charge multiple of 1 ($P < 0.0001$, Table I). The maximum safe charge multiple was 26 ± 9 with an average stored charge of $1,227 \pm 423 \mu\text{C}$, and the minimum VF inducing charge multiple was 30 ± 11 with an average stored charge of $1,451 \pm 509 \mu\text{C}$.

The maximum safe levels and minimum VFI levels of stored charge for experimental data were regressed linearly for significant trends. The relationship between stored charge as a function of weight (kg) was compared to experimental stored charge for minimum VF induction discharge. The maximum safe discharge was modeled by $12.5 * [\text{weight (kg)}] + 473$ ($n = 9$, $r^2 =$

0.69) and the minimum VF induction discharge was modeled by $16.5 * [\text{weight (kg)}] + 460$ ($n = 9$, $r^2 = 0.82$). The analysis revealed a linear, increasing relationship of maximum safe and minimum VFI discharge multiples (and therefore safety index) as a function of weight (kg). The relationship further confirmed a significantly greater discharge required to induce VF compared to standard discharge levels for a fielded NMI device.

Logistic regression showed that the mean charge multiple for a 50% likelihood of VF induction was 24 ± 13 , with an odds ratio of 0.85 after adjustment for weight (95% Wald confidence limits: 0.83, 0.88, $P < 0.0001$). Therefore, an increasing charge multiple was shown to be independently related to an increase in VF induction.

Discussion

This study confirmed the cardiac safety of an experimental NMI device emulating the performance of commercially used devices. An NMI discharge that could induce VF required 15–42 times the charge of the standard NMI discharge. Furthermore, this study demonstrated a safety index strongly correlated with increasing weight. In addition, the observation of the hemodynamic stability of the animals suggests that these devices may be safely applied multiple times if needed. Discharge levels output by fielded NMI devices have an extremely low probability of inducing VF.

This study used adult domestic pigs chosen to simulate a range of adult human body weights between 30 and 120 kg, likely to be encountered in police work. Our results suggest a safety index

Table I.
Experimental Outcomes for 19 Pulse per Second Discharges

Pig	Weight (kg)	Max Safe Multiple	Safe Stored Charge (μC)	Min VFI Multiple	VFI Stored Charge (μC)	Threshold Charge (μC)	Safety Index
1	83	28	1344	32	1536	1440	30
2	54	28	1344	32	1536	1440	30
4	48	28	1344	32	1536	1440	30
5	81	40	1920	44	2112	2016	42
6	49	20	960	24	1152	1056	22
7	42	20	960	24	1152	1056	22
8	37	16	768	20	960	864	18
9	117	36	1728	48	2304	2016	42
10	30	14	672	16	768	720	15
	60 ± 28	26 ± 9	1227 ± 423	30 ± 11	1451 ± 509	1339 ± 463	28 ± 10

μC = microcoulombs; VFI = ventricular fibrillation induction.

SAFETY OF NEUROMUSCULAR INCAPACITATING DEVICE

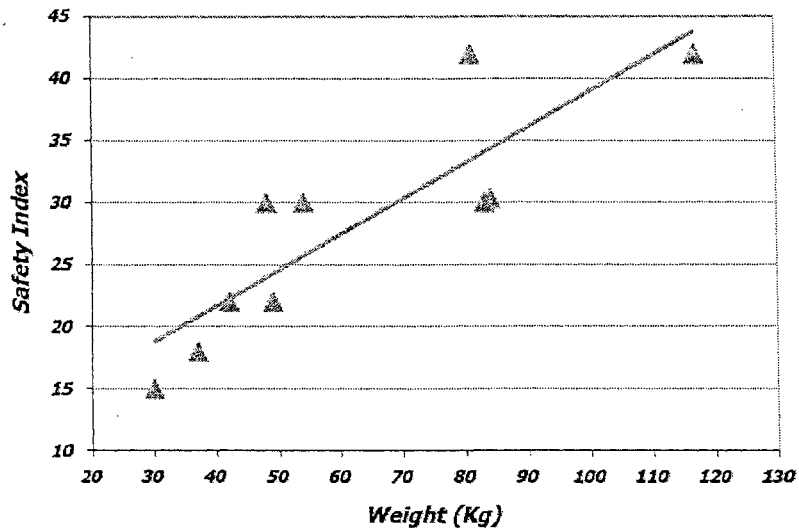


Figure 3. NMI safety index ($\blacktriangle$, triangle) in relationship to weight (kg). The safety index is the ratio of VF induction threshold discharge to fielded NMI discharge.

≥ 20 for human adults >45 kg. The standard NMI devices may therefore have a safety index significantly >20 for field applications to adult humans.

The minimum discharge that would cause fibrillation was approximately 15 times the charge of the standard pulse when used on the smallest pig.

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Electromuscular incapacitating devices

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Abstract: An electromuscular incapacitating device (EMD) temporarily incapacitates combative individuals so they can be apprehended with minimal harm to themselves, bystanders, or law enforcement agents. Many newspaper articles [1] have suggested that EMDs can kill those apprehended. A peer reviewed study on anesthetized pigs reports that there is a large safety factor that prevents EMDs from killing [2]. Biomedical engineers, with knowledge of the effects of electricity on the body can provide information to clarify this conflict.

Introduction

An electromuscular incapacitating device (EMD) temporarily incapacitates persons so they can be apprehended with minimal harm to themselves, bystanders, or law enforcement agents. Many newspaper articles [1] have suggested that EMDs can kill those apprehended. A peer reviewed study on anesthetized pigs reports that there is a large safety factor that prevents EMDs from killing [2]. Biomedical engineers, with knowledge of the effects of electricity on the body can provide information to clarify this conflict.

An electromuscular incapacitating device (EMD) presents law enforcement with another less-lethal option for subduing violent individuals who pose a threat to themselves and others. More commonly known as stun guns, or as a Taser®, they deliver a high voltage electric charge that disrupts the nervous system, causing the suspect to lose control and fall to the ground. The public safety scenarios that require law enforcement or corrections officers to resort to the use of force to stop aggressive, violent, self-destructive or simply noncompliant illegal behavior vary tremendously. Such behavior can come from individuals, groups, or crowds who refuse to obey a lawful order, or threaten to use force (with or without weapons). The people encountered can range from aggressors who are hardened criminals to mentally disturbed teenagers with no criminal history, from protesting crowds that include children and elderly, to street gangs, youthful looters, and innocent bystanders on a street. Less lethal weapons are designed to temporarily incapacitate, confuse, delay, or restrain an adversary in a variety of situations. They have been used in riots, prison disturbances, and hostage rescues, but most often are employed in one-on-one situations. They are valuable when: lethal force is not appropriate, lethal force is justified and available for backup but lesser force may subdue the aggressor, or lethal force is justified but its use could cause collateral effects, such

as injury to bystanders or life-threatening damage to property and environment.

Materials and Methods

It is useful to understand the operation of EMDs. All generate voltages of about 50 kV, currents of up to about 15 A, pulse durations of about 10 μ s, repetition rates of about 20 pulses/s, for about 5 s, and can ionize an air gap to form an arc about 50 mm long. Early EMDs, called stun guns, required close contact with the person, and since the electrodes are about 50 mm apart, only affected a small target area. Later EMDs used a compressed gas propellant to fire barbed darts with trailing insulated wires about 7 m long at an 8° angle so the darts would stick on clothing or the skin a distance of about 50 cm apart to cause muscle contraction and pain over a larger group of muscles. Fig. 1 shows a typical circuit for the Taser M26 [3]. The battery drives a 500 Hz oscillator with transformer step up from 2.5 to 6 V up to 2 kV, which is rectified and forms a high-voltage power supply to charge up the capacitor. When the capacitor voltage reaches about 2 kV, the spark gap breaks down and the 2 kV is delivered across the primary of the transformer, which steps it up to about 50 kV, which will ionize an air gap of 50 mm. If the barbs strike the skin, the 15 A through the typical body resistance of 300 Ω yields 4500 V. If the barbs strike clothing, the arc jumps through the air but the body voltage is still 4500 V. Numerous groups of skeletal muscles contract, and the person loses his ability to maintain an erect, balanced posture and falls to the ground and is temporarily incapacitated.

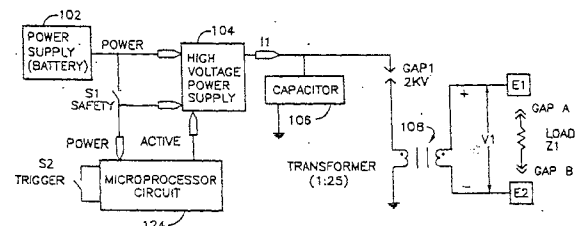


Figure 1: When the 0.88 μ F capacitor voltage reaches 2 kV, the spark gap breaks down. The 1:25 transformer creates 50 kV. From [4].

Figure 2 shows an improved Taser X26 EMD [3]. Capacitor 1 generates 50 kV at the output to break down the air resistance. Then capacitor 2 provides a sustaining current at lower voltage. The result is lowered battery requirement.

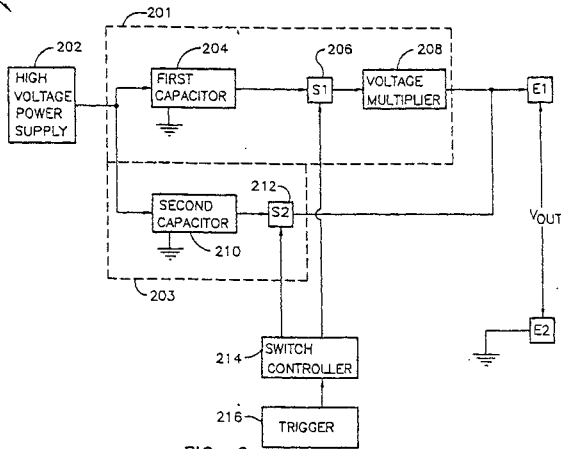


Figure 2: 0.07 μF capacitor 1 breaks down the air gap in 1.5 μs (arc phase). 0.01 μF capacitor 2 provides a low voltage sustaining current for 50 μs (stim phase). From [4].

Figure 3 shows a standard waveform of about 2 A for about 50 μs . The larger currents were used to determine cardiac safety factor, which varied from 15 $\times$ to 42 $\times$, as pig weight increased from 30 to 117 kg.

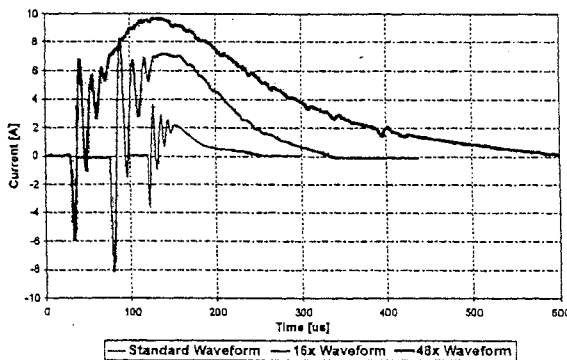


Figure 3: The standard waveform from the TASER model X26 EMD delivers about 2 A for about 50 μs . From [2]

Geddes and Baker [5] have developed the strength-duration curve shown in Figure 4. They estimate the time constant τ for cardiac muscle is about 2 ms. For an EMD duration of 50 μs , current must be increased over that required for long durations by a factor of 50 to cause cardiac excitation.

We are developing a computer model of currents that flow through the body in response to EMD darts at a variety of locations. Intuition suggests that a dart is more likely to induce ventricular fibrillation (VF) if near the heart rather than farther away. We will map the contours of cardiac safety factor for inducing VF. We will verify the model by tests in which we use a 64-electrode Constellation catheter placed within the anesthetized pig's heart. We will also test larger currents from the surface as shown in Figure 3.

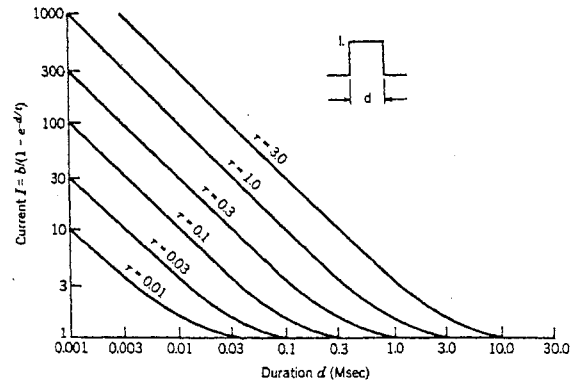


Figure 4: Short duration pulses require higher currents to cause excitation. From [5]. Charge $Q = Id$ remains constant for short pulses.

If the EMD electric shock induces VF, the blood pressure would drop to near zero in about 5 s [6]. The human target would lose consciousness within 30 s and fall to the ground. Because in the large majority of deaths following EMD, loss of consciousness does not occur within 1 min, we conclude that the electric shock did not directly cause VF. One alternative hypothesis for death following EMD shock is that the person died of cocaine overdose [7]. Cocaine is a myotoxic drug, which can lead to rhabdomyolysis, hyperkalemia, and cardiac asystole.

References

- [1] BERENSON, A. (2004): 'As police use of Tasers rises, questions over safety increase', The New York Times, CLIII (52,914), Sunday July 18
- [2] MCDANIEL, W. C., STRATBUCKER, R. A., NERHEIM, M., BREWER, J. E. (2005): 'Cardiac safety of neuromuscular incapacitating defensive devices', PACE Supplement 1, 28, pp. S284-7
- [3] Taser M26 and X26 manuals <http://www.taser.com/index.htm>
- [4] NERHEIM, M. H. (2004): 'Electronic disabling device', International patent application WO 2004/073361 A2
- [5] GEDDES, L. A., AND BAKER, L. E. (1989): 'Principles of applied biomedical instrumentation' 3rd ed., (John Wiley & Sons, New York), p. 460
- [6] ANTONI, H. (1998): 'Electrical properties of the heart', in REILLY, J. P. (Ed): 'Applied bioelectricity from electrical stimulation to electropathology', (Springer, New York), p. 181
- [7] LAUR, D. (2004): 'Excited delirium and its correlation to sudden and unexpected death proximal to restraint', (Canada: Victoria Police Department) http://www.taser.com/facts/medical_info.htm

This project was supported by Grant No. 2004-IJ-CX-K036 awarded by the National Institute of Justice, Office of Justice Programs, US Department of Justice. Points of view in this document are those of the author and do not necessarily represent the official position or policies of the US Department of Justice.

Effectiveness & Health Effects of Electro-Muscular Incapacitating Devices

16 November 2004



**James R. Jauchem, PhD
Senior Research Physiologist
Human Effectiveness Directorate
Air Force Research Laboratory**



Outline



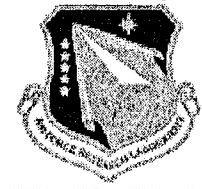
Studies at the Air Force Research Laboratory

- I. Behavioral**
- II. Variable pulses**
- III. Repeated 5-sec exposures**

Remaining questions for future research



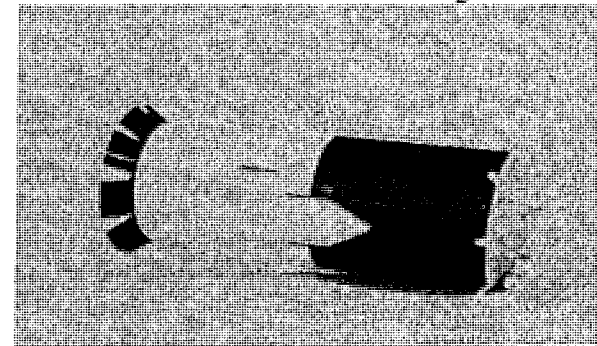
Terminology



TASER® = “Thomas A. Swift Electric Rifle” (1974)

“Electromuscular Disruption” Devices: Term used by TASER International.

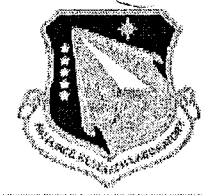
“TASER-like devices”: Generic term to include items not under registered trademark.



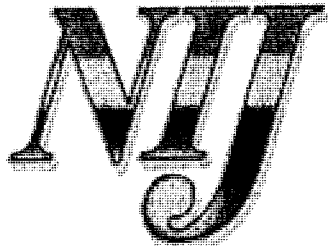
New term: Electro-Muscular Incapacitation



Inter-Departmental Relationships

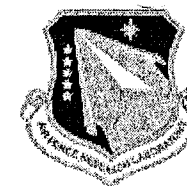


Need for partnerships among different government departments (Justice and Defense) and local law enforcement.



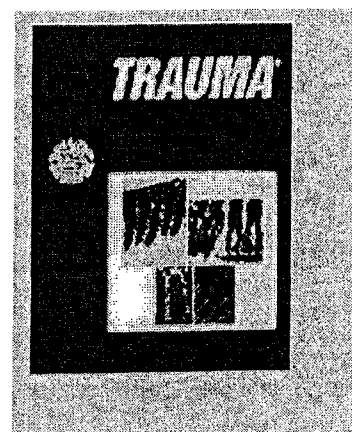
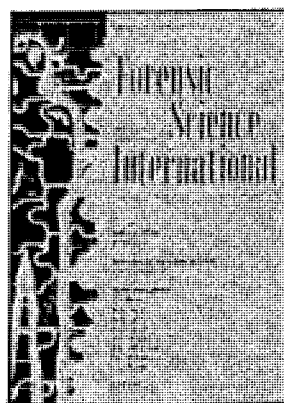
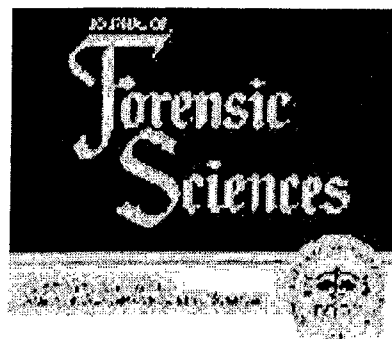


Previous Literature



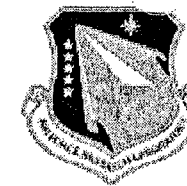
Very little peer-reviewed literature.

Mostly case reports.





Air Force Colleagues

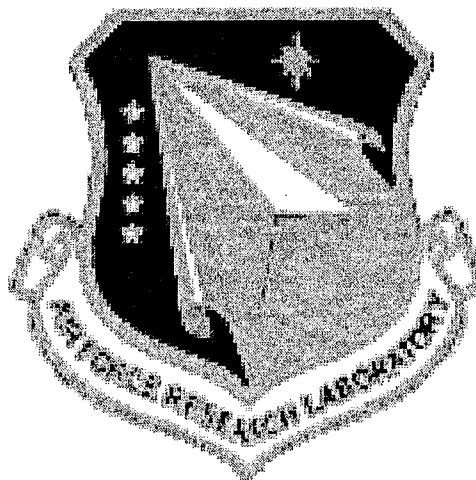


Air Force Research Laboratory

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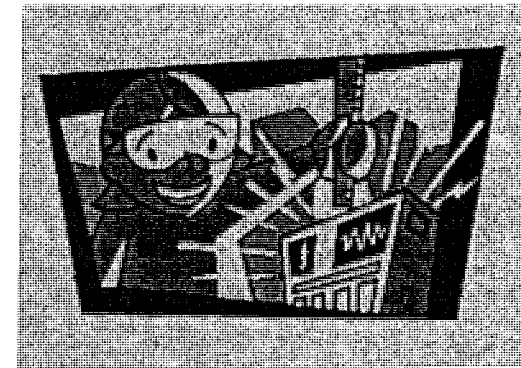
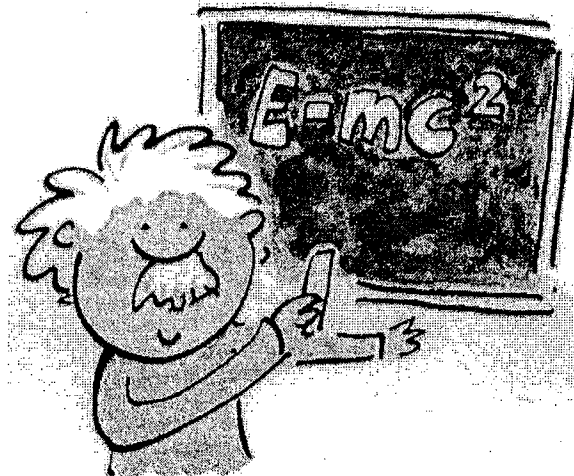
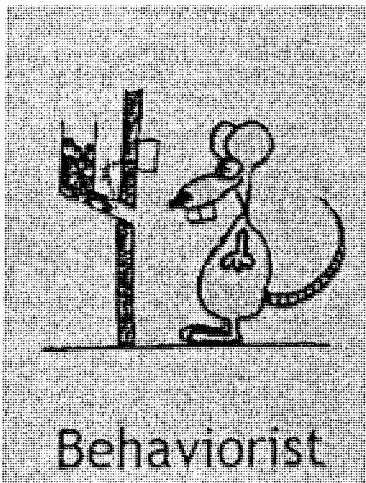
D.A. Fines



C.D. Clark

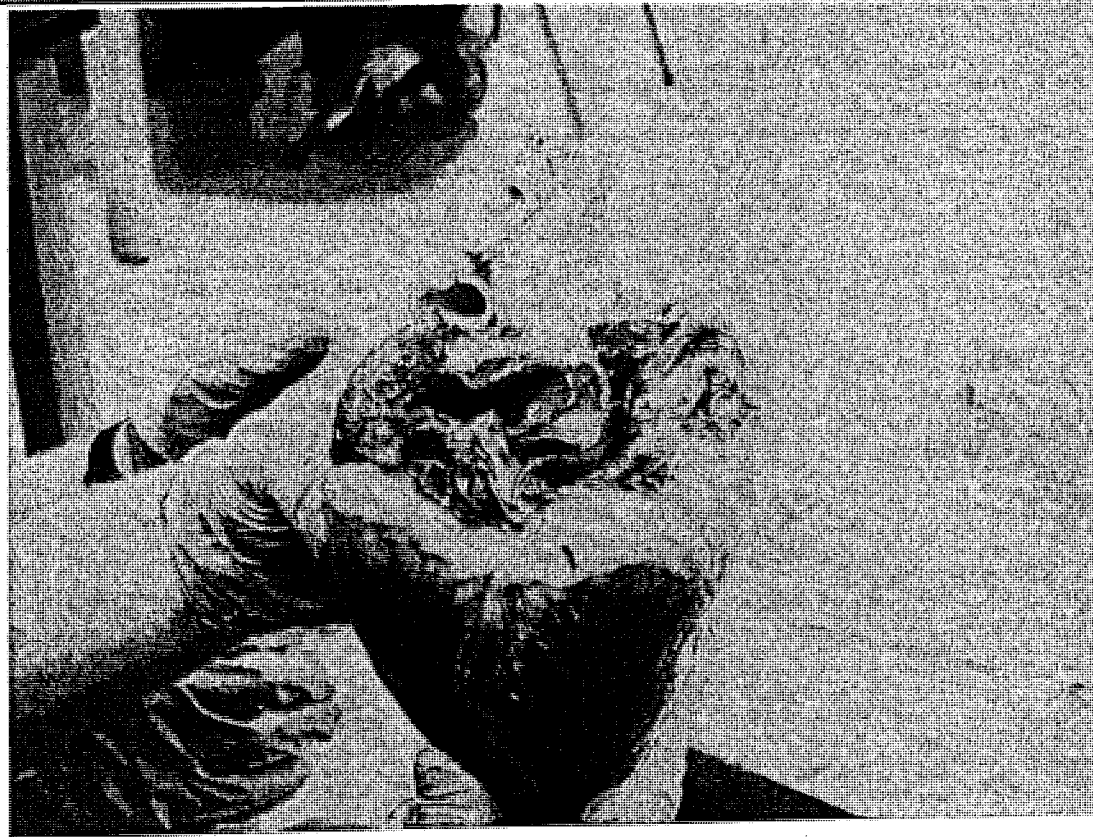
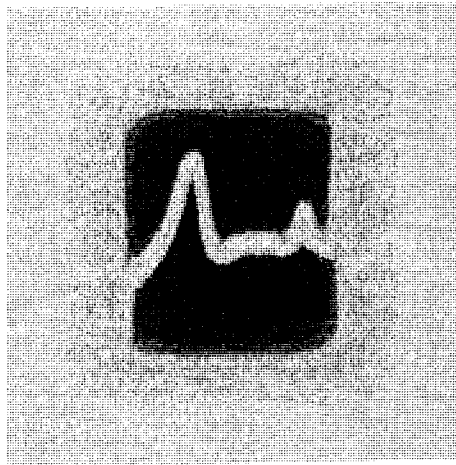
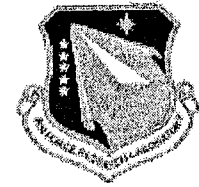
J.L. Ashmore

J.E. Parker





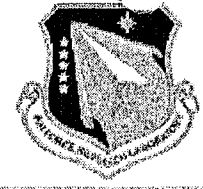
Pig: Similarities to Human



**Ratio of heart size to body weight.
Similar coronary arterial distribution.
Susceptible to ventricular fibrillation.**



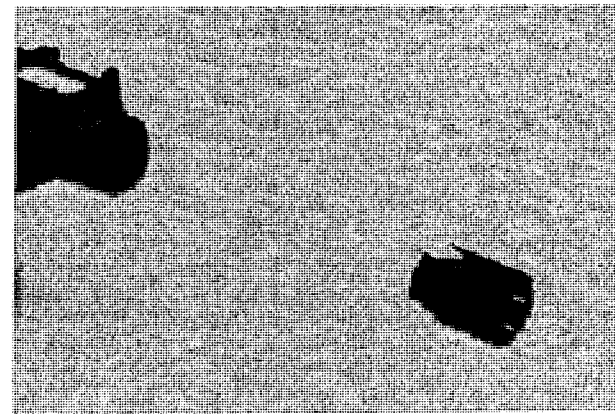
Behavioral Studies



NJ



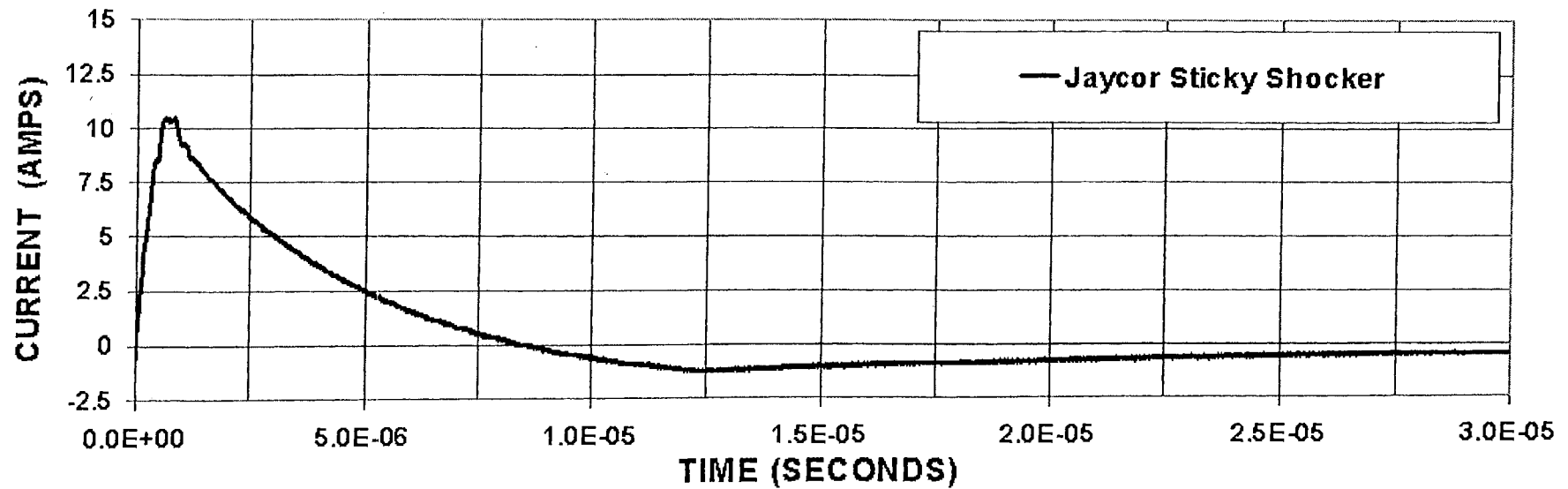
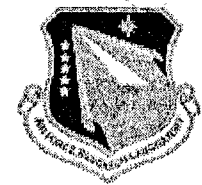
Existing commercial device



"Sticky shocker" prototype

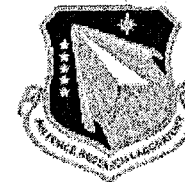


“Sticky Shocker”





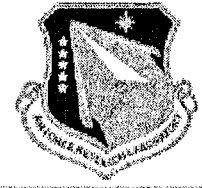
Behavioral Studies



Device	Measures of Decreasing Muscle Coordination				Electrical Characteristics of Device		
	Circle	Jump Against Wall	Jump Over Wall	Lost Posture	Peak Current (Amps)	RMS Current (Amps)	5% Of Peak Pulse Width (nsec)
N size = 11 animals							
Jaycor Sticky Shocker	10	4	0	0	11	2.7	29,000
Tasertron TE 86	7	4	1	0	6	3.5	8,700
Tasertron HP 95	11	3	1	0	8.5	4.8	13,000
TASER Int Model 34000	6	7	0	0	9	3.5	20,000
TASER Int Model 44000	10	10	0	7	14	5.5	20,000



Technical Report



An evaluation of the electrical properties and bio-behavioral effects of four commercially available TASERs and the Jaycor Sticky Shocker. US Air Force Research Laboratory Technical Report AFRL-HE-BR-TR-2003-0089, June 2003.

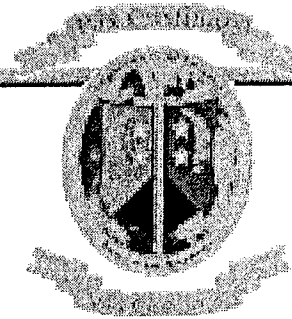
Available from:

**Defense Technical
Information Center**

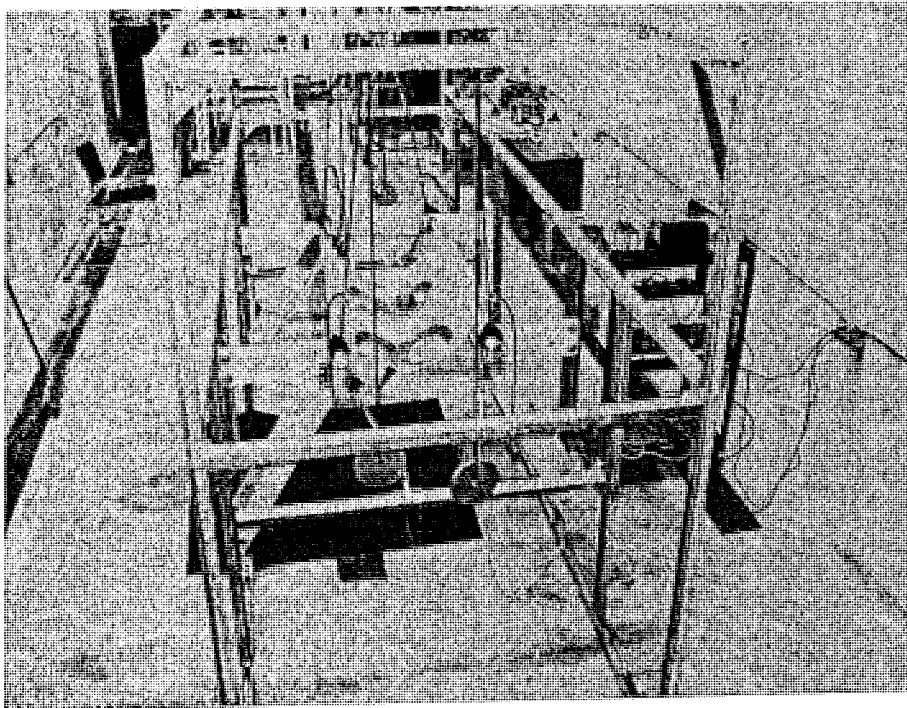
<http://www.dtic.mil/>



Marine Corps Systems Command & JNLWD

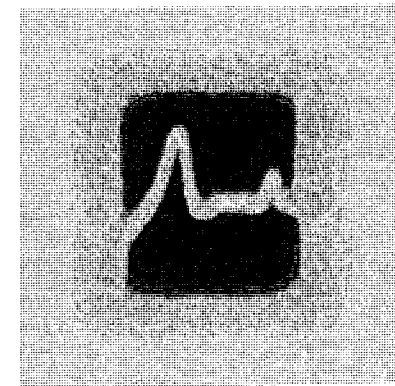


Effectiveness (muscle contraction)



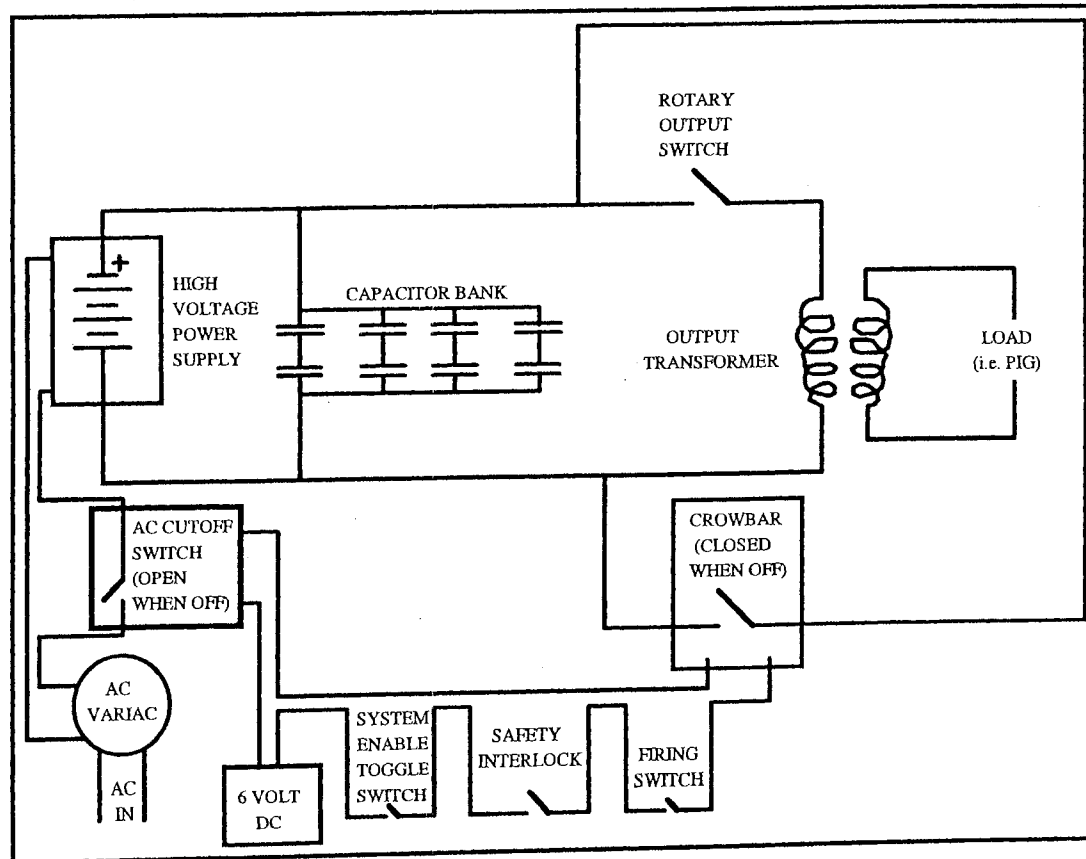
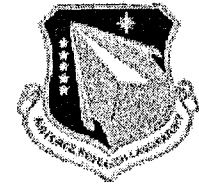
Muscle Contraction Test Structure

Safety (lack of fibrillation)

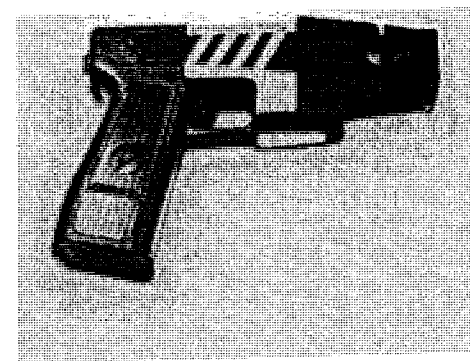


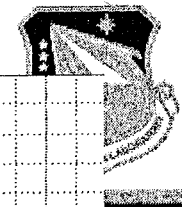


New Laboratory Device

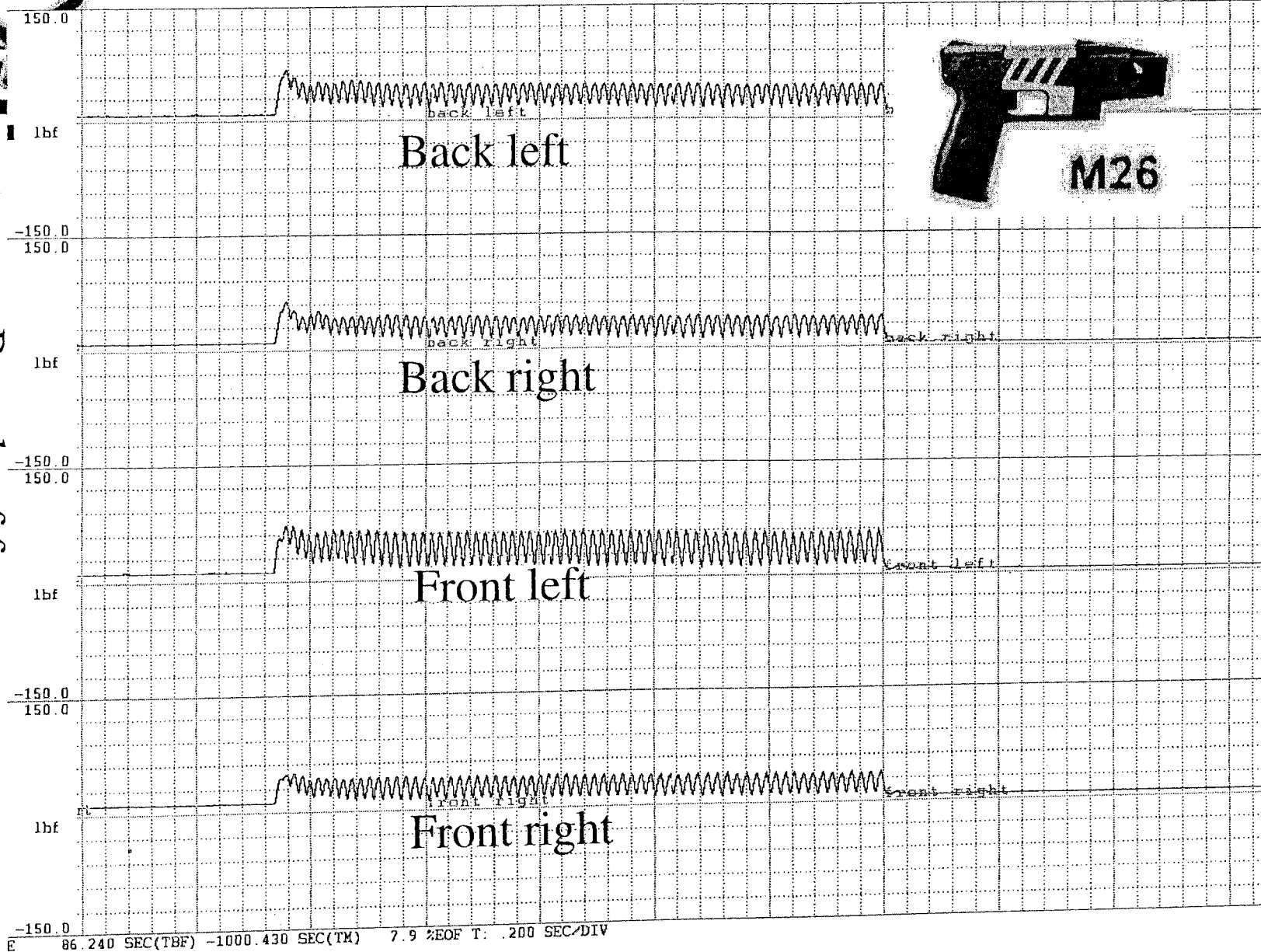


Effects compared to commercial device:



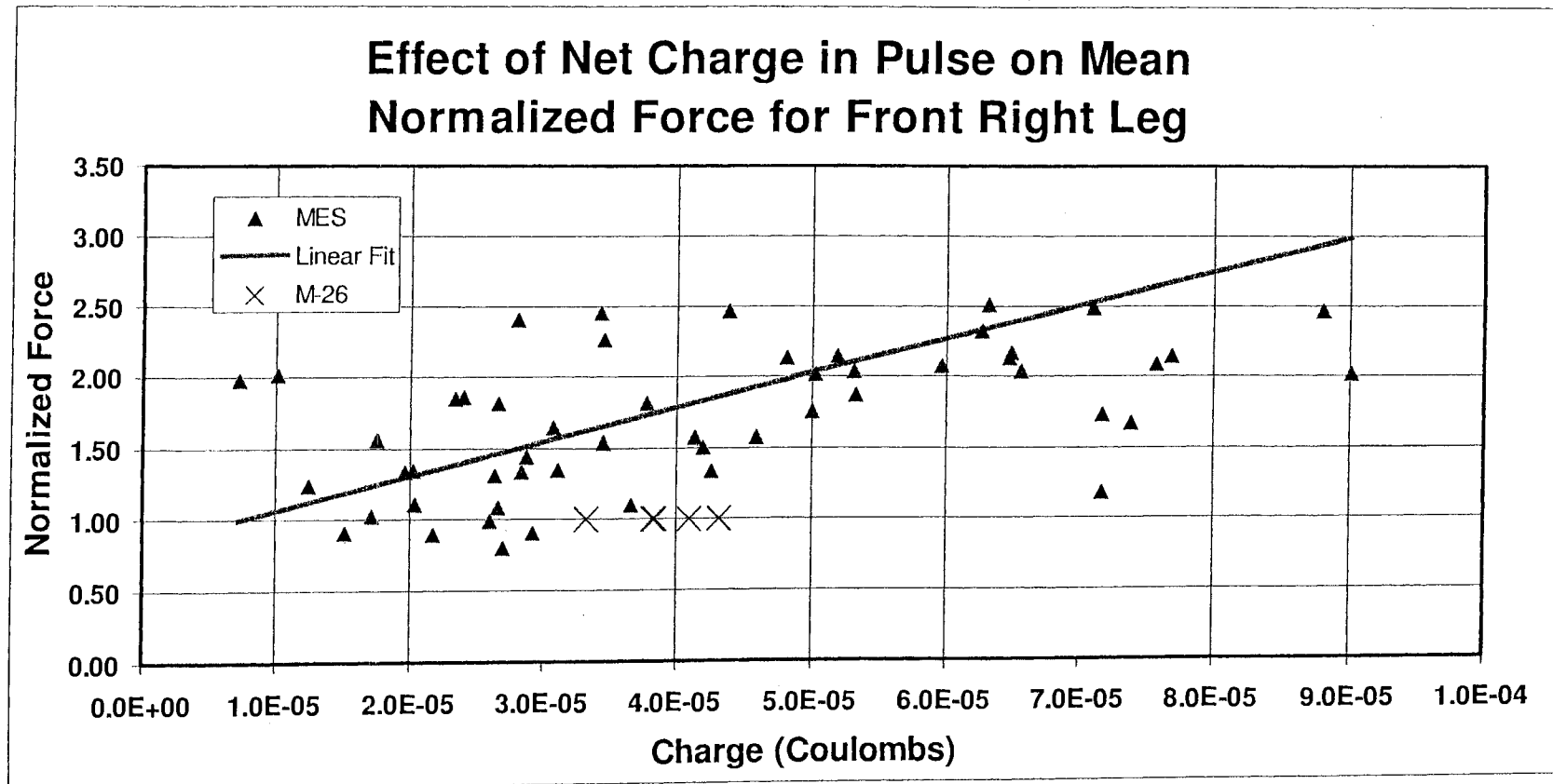
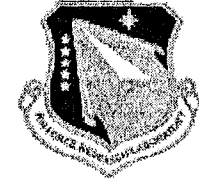


Pounds of force





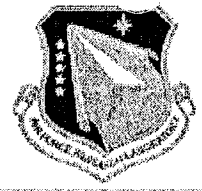
Varying Parameters Can Increase Strength of Muscle Contraction



(Similar results were found for pulse duration.)



Technical Report



Variable TASER parameters: Effectiveness (muscle contraction) and cardiac safety (ventricular fibrillation). US Air Force Research Laboratory Technical Report AFRL-HE-BR-TR-2004-0094, Sept. 2004.



Dissemination of this document is controlled under DoD Directive 5230.25.

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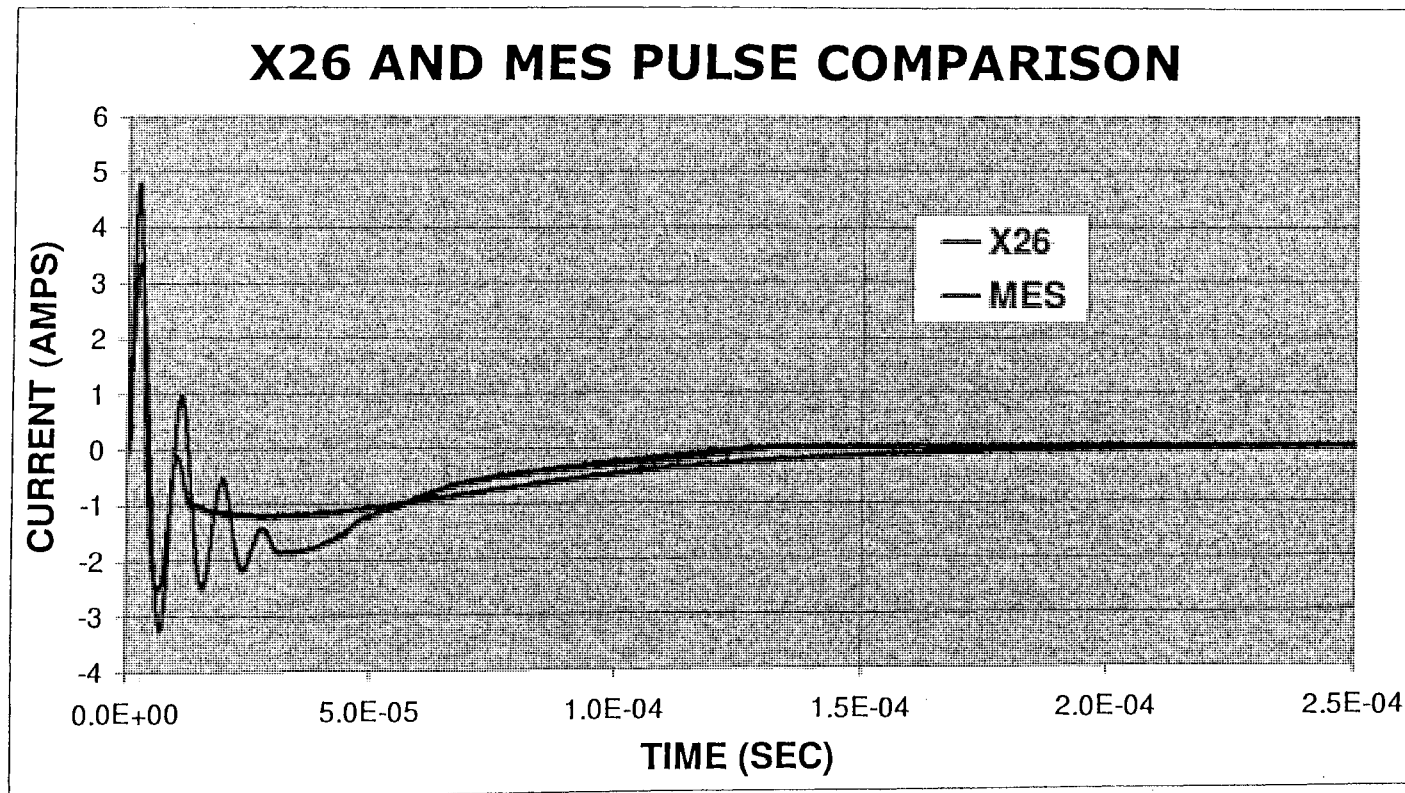
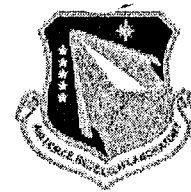
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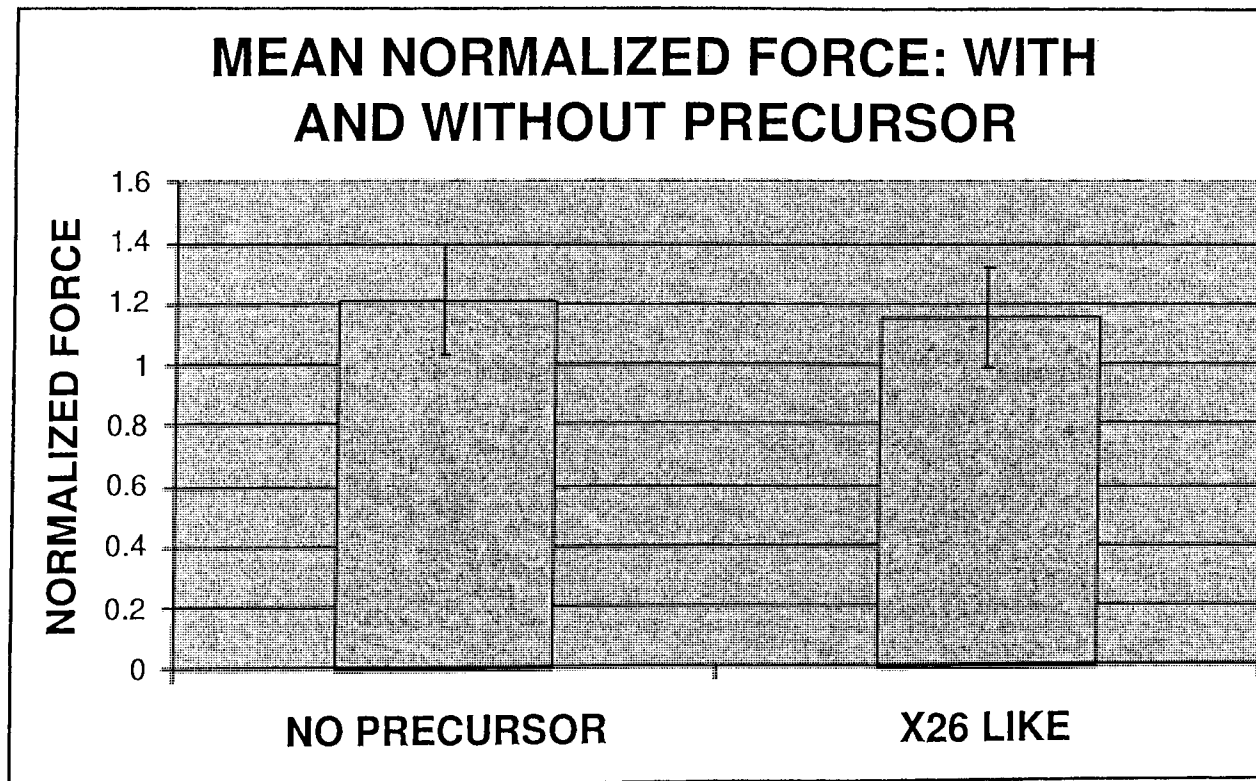
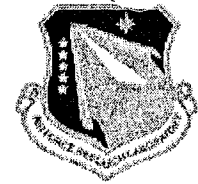


Modifiable Electronic Stimulator ("MES")



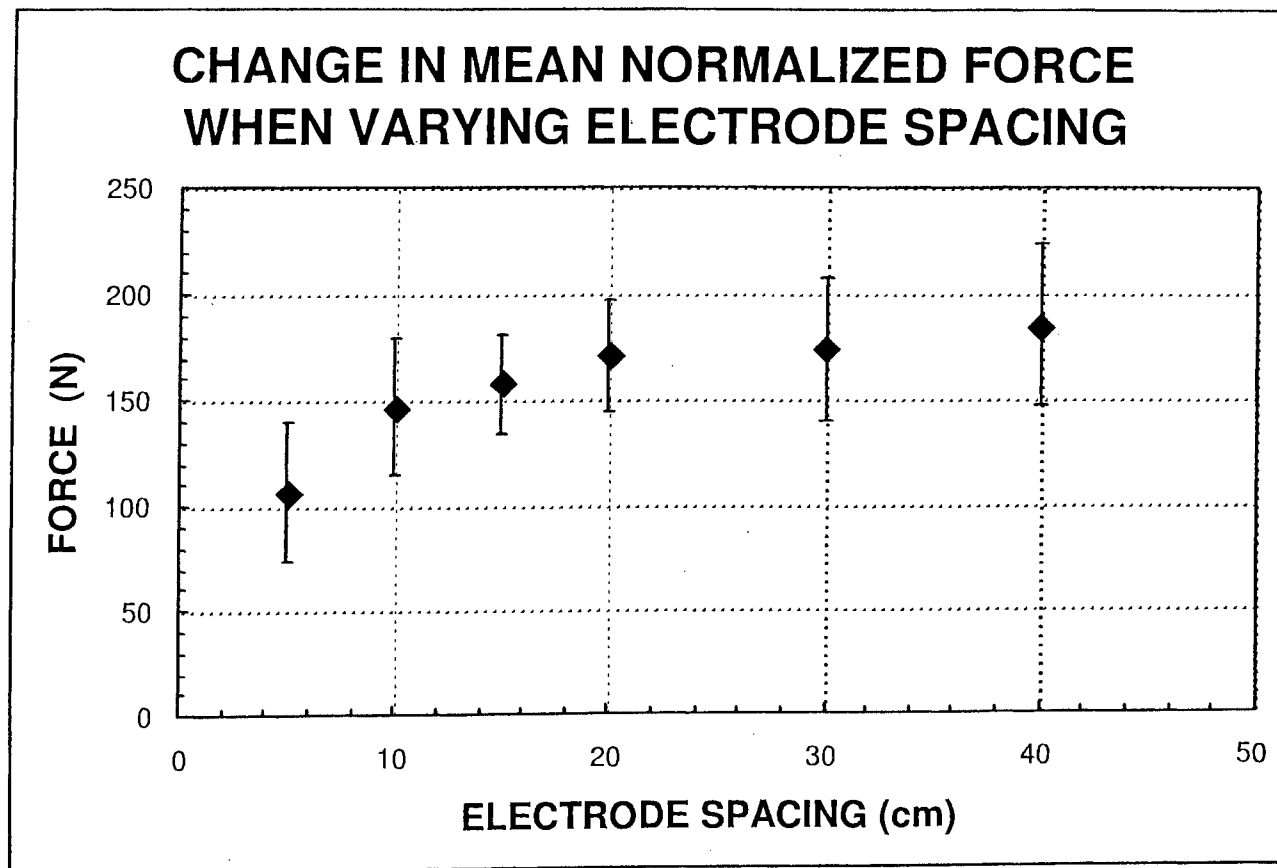
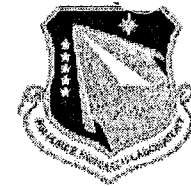


Muscle contraction force



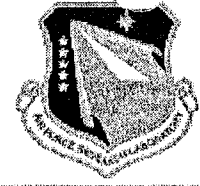


Electrode spacing effects





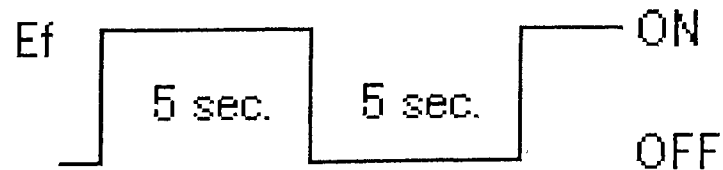
Repeated exposures



Swine were exposed for 5 sec,

followed by a 5-sec period of no exposure,

repeatedly for 3 min.

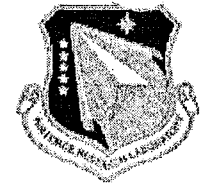


After a 1-hr delay,

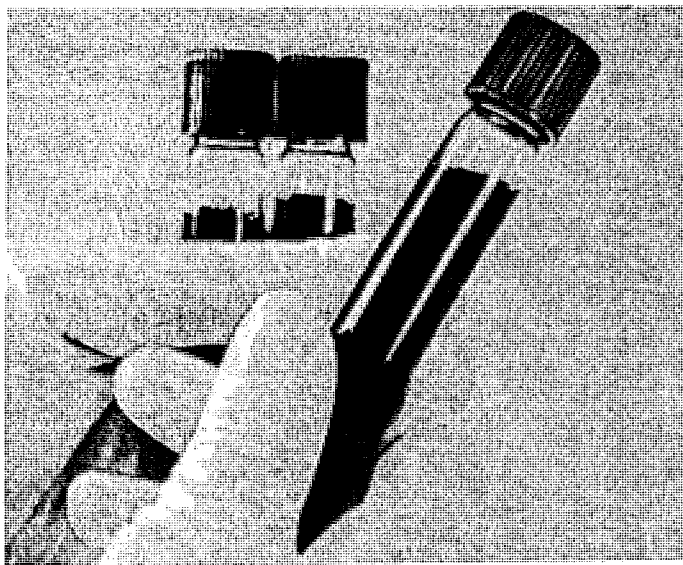
a second 3-min exposure period was added.



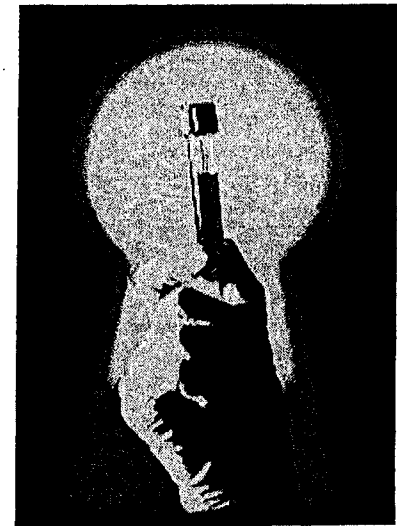
Plasma Levels of Substances



Muscle damage due to repeated contractions could cause release of substances into bloodstream.



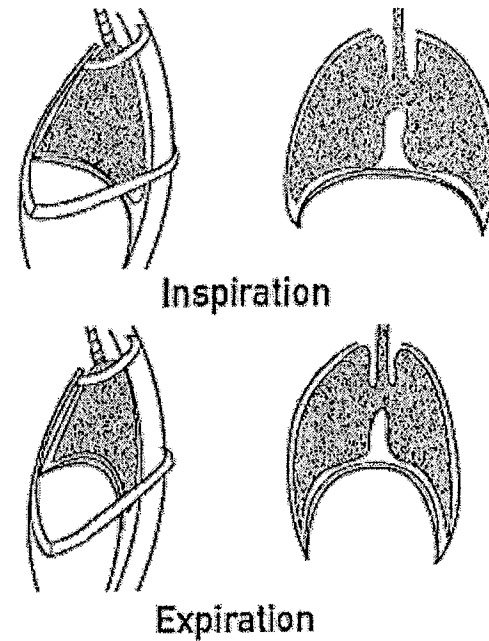
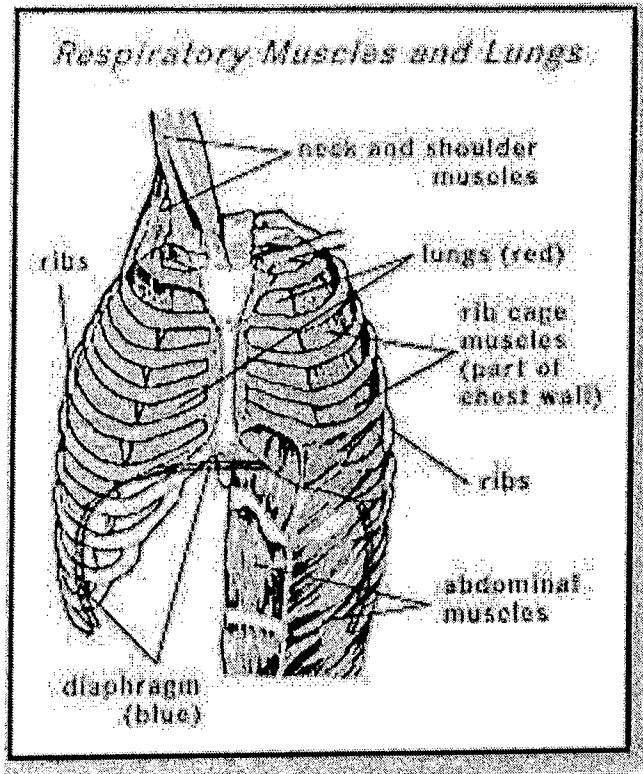
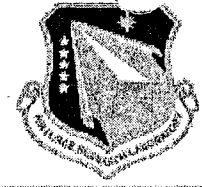

Potassium



**Creatine Phosphokinase
Lactate Dehydrogenase
Troponin**



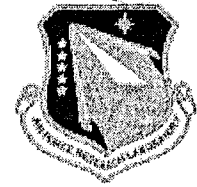
Interruption of Respiration



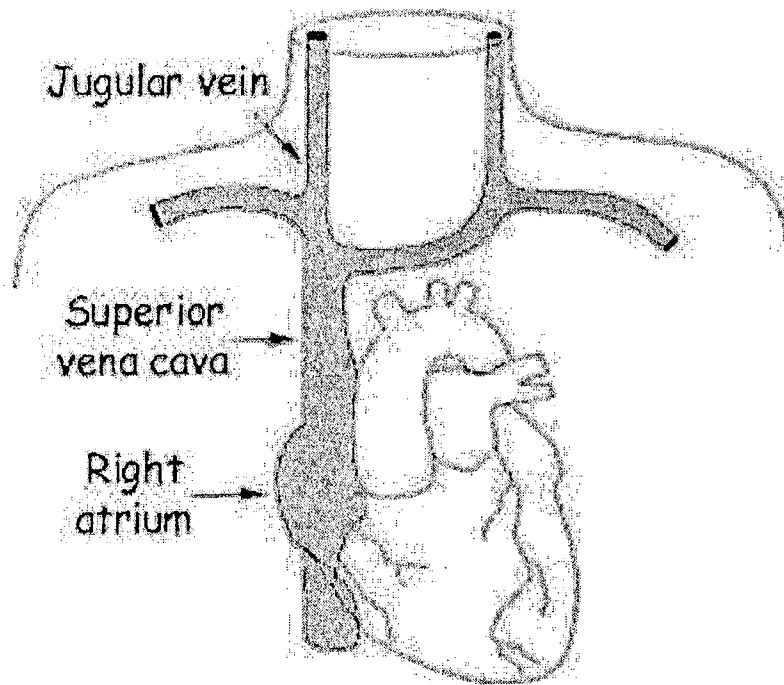
Effects on blood gases unknown.



Techniques



Central venous blood sampling

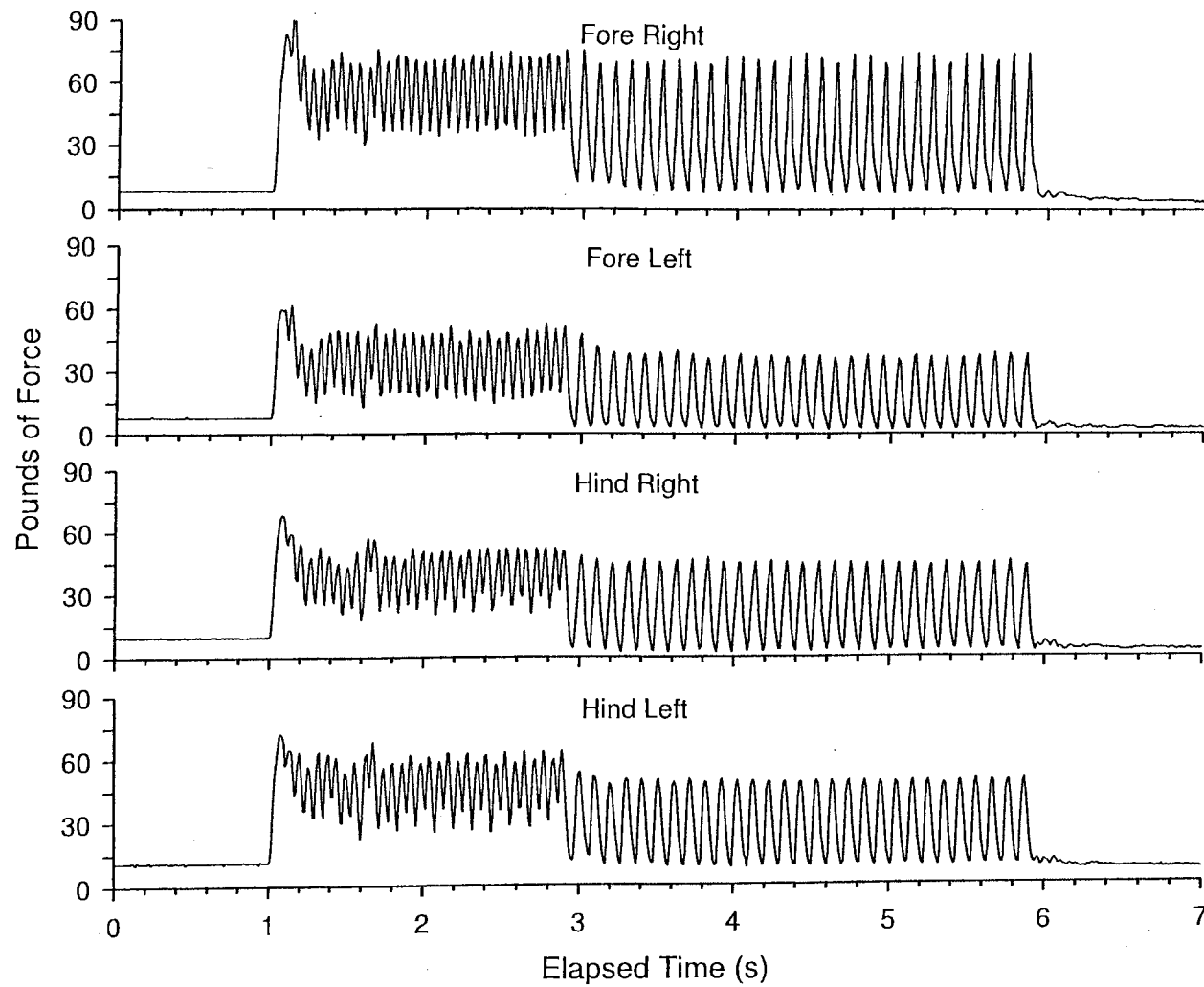


Pulse oximetry



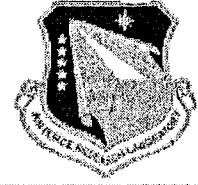


Limb contractions: X26





Blood pH



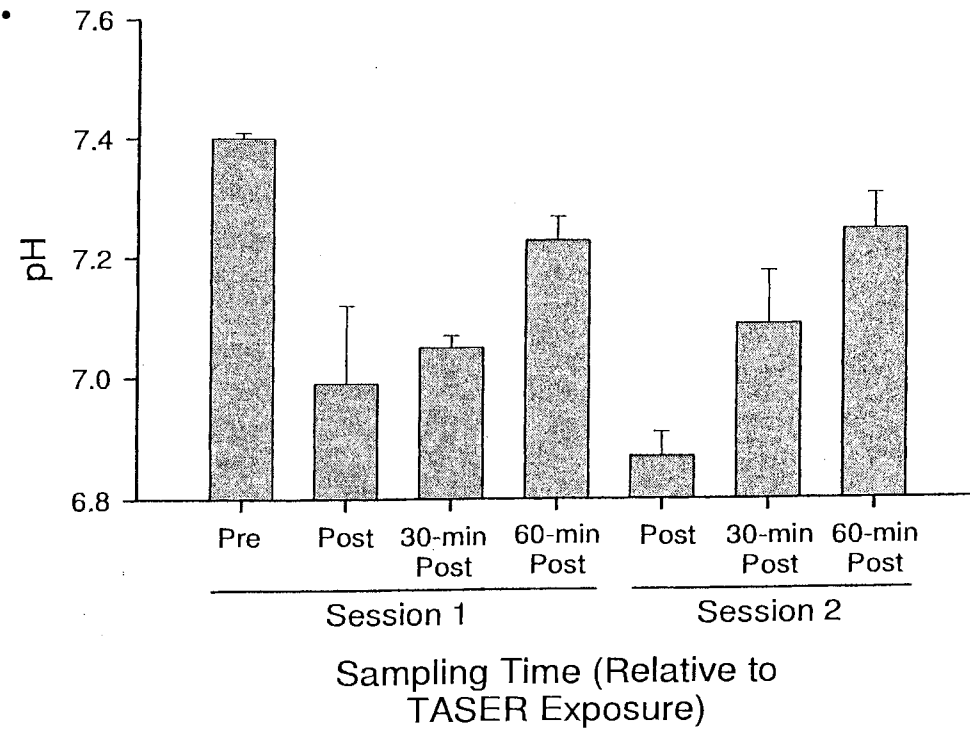
Significant findings:

Several changes in blood chemistry.

Blood became acidic, but returned toward normal 1 hr after exposure.

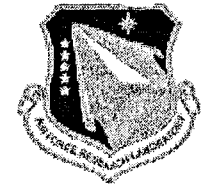
Scenario is feasible. Caveat: medical monitoring of subjects.

Porcine Whole Blood pH
Pre and Post Application of TASER

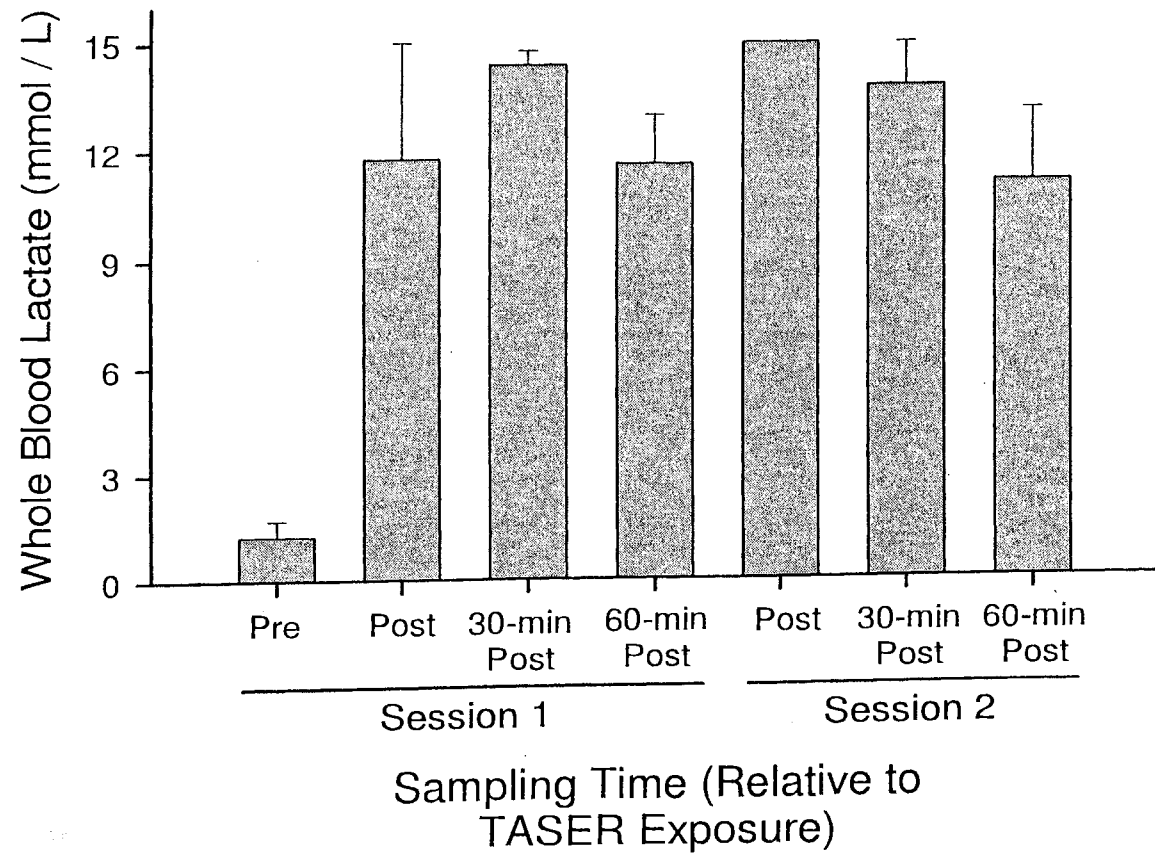




Lactate

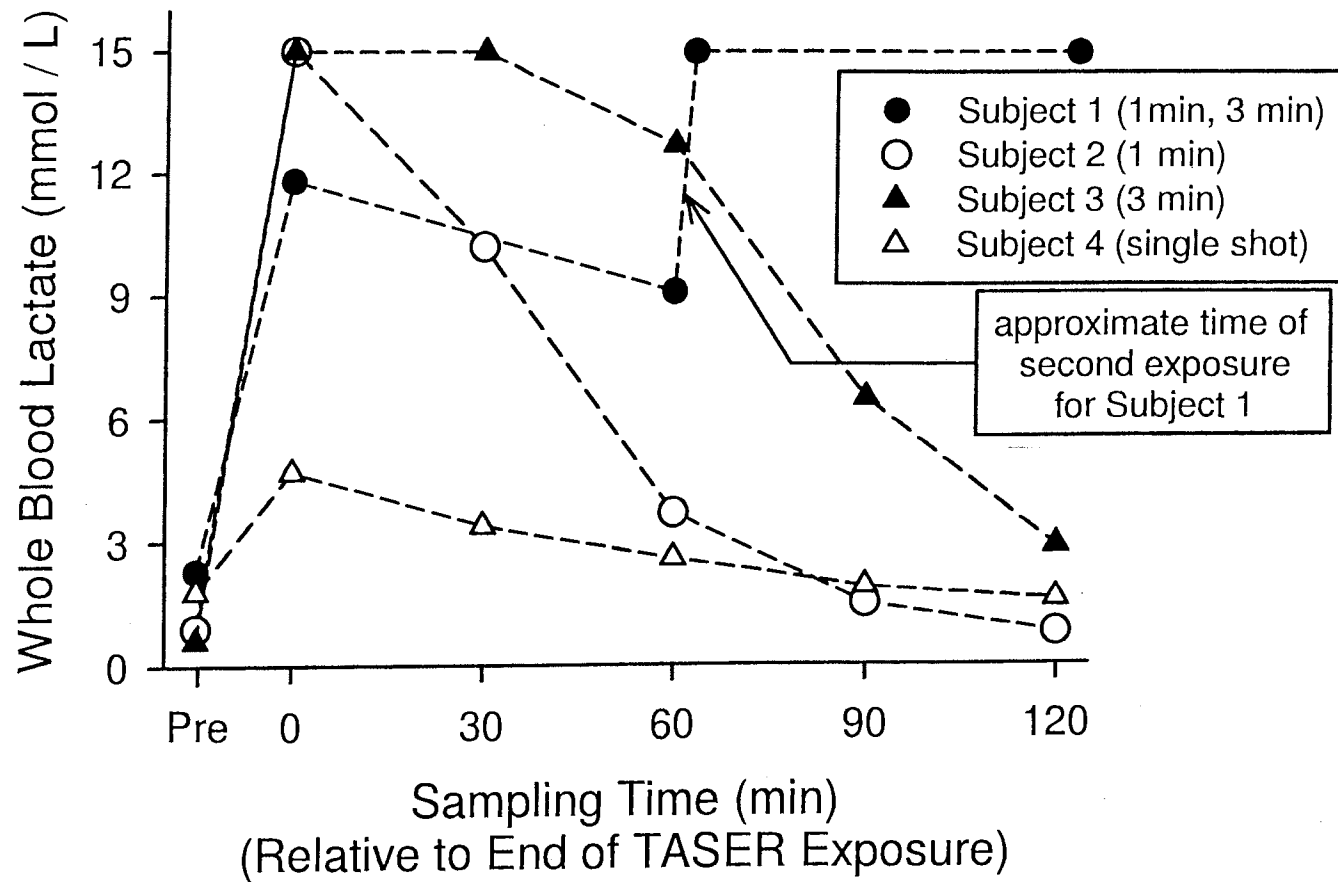
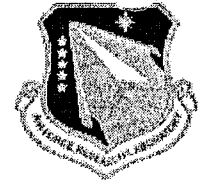


Porcine Whole Blood Lactate Levels
Pre and Post Application of TASER



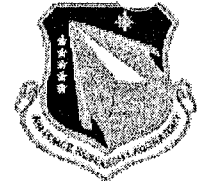


Pilot study: lactate

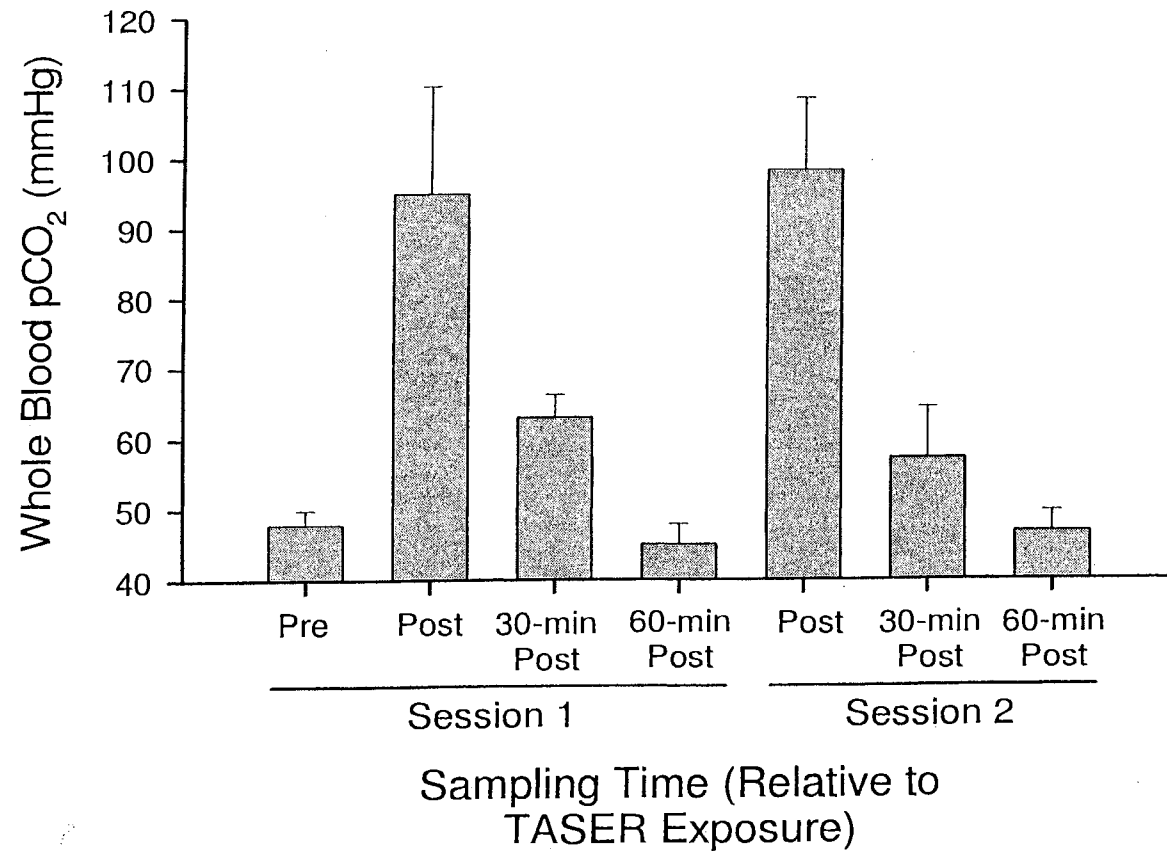




Blood CO₂

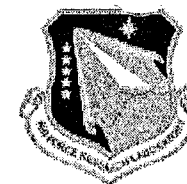


Porcine Whole Blood pCO₂
Pre and Post Application of TASER

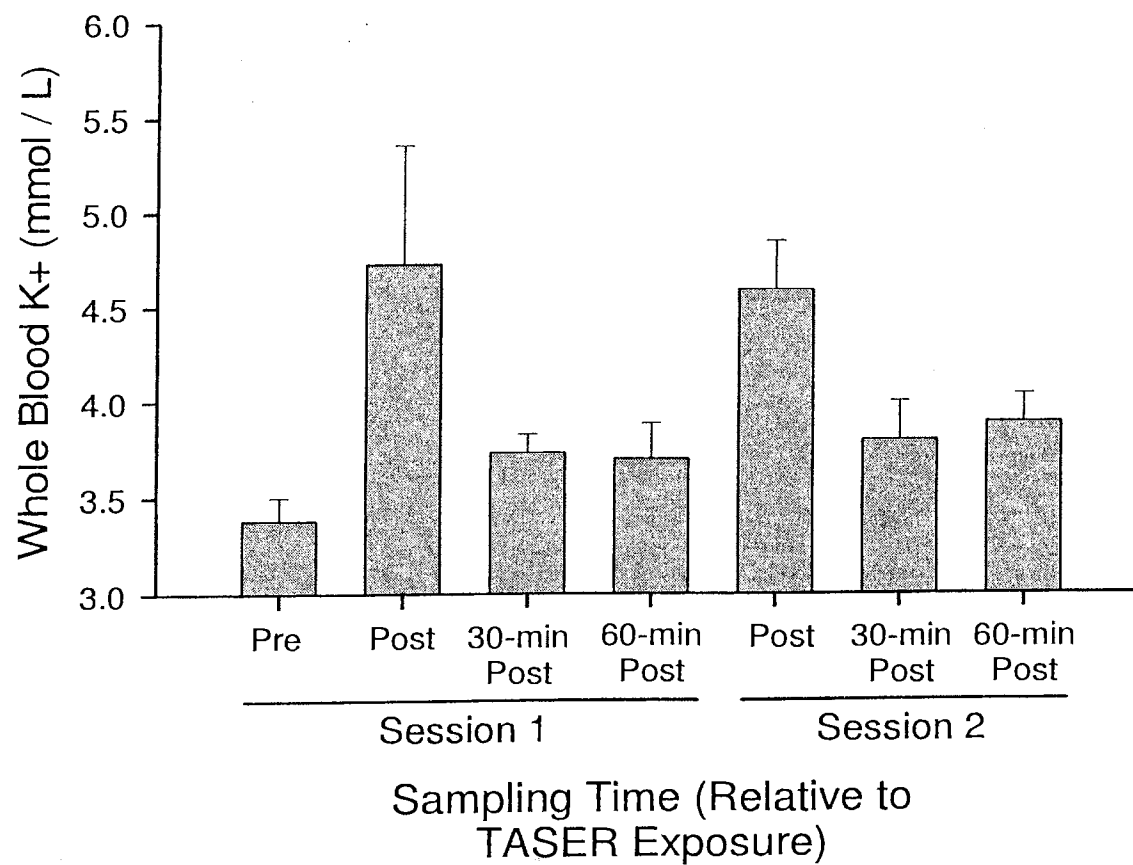




Potassium

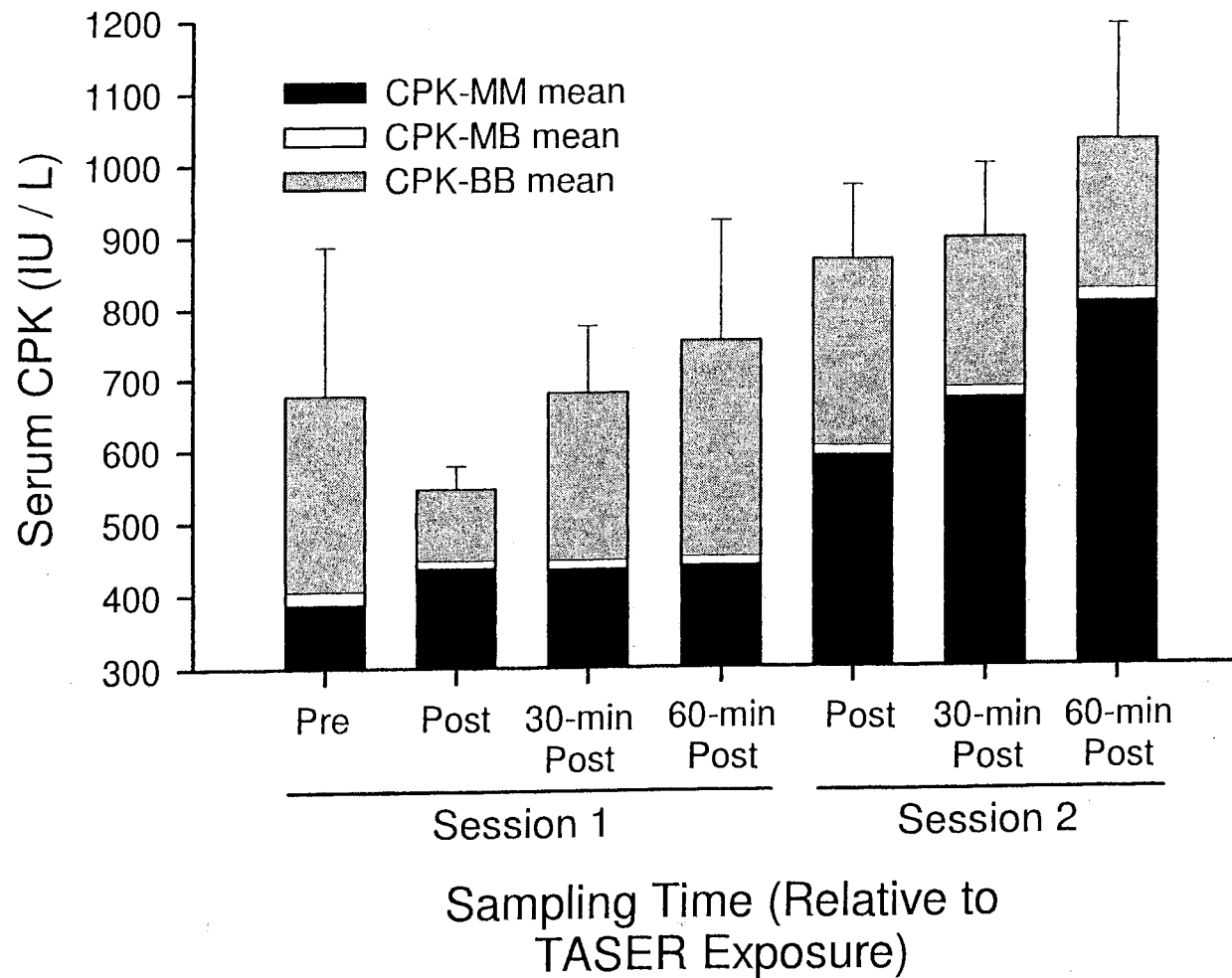
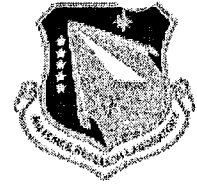


Porcine Whole Blood K⁺ Levels
Pre and Post Application of TASER



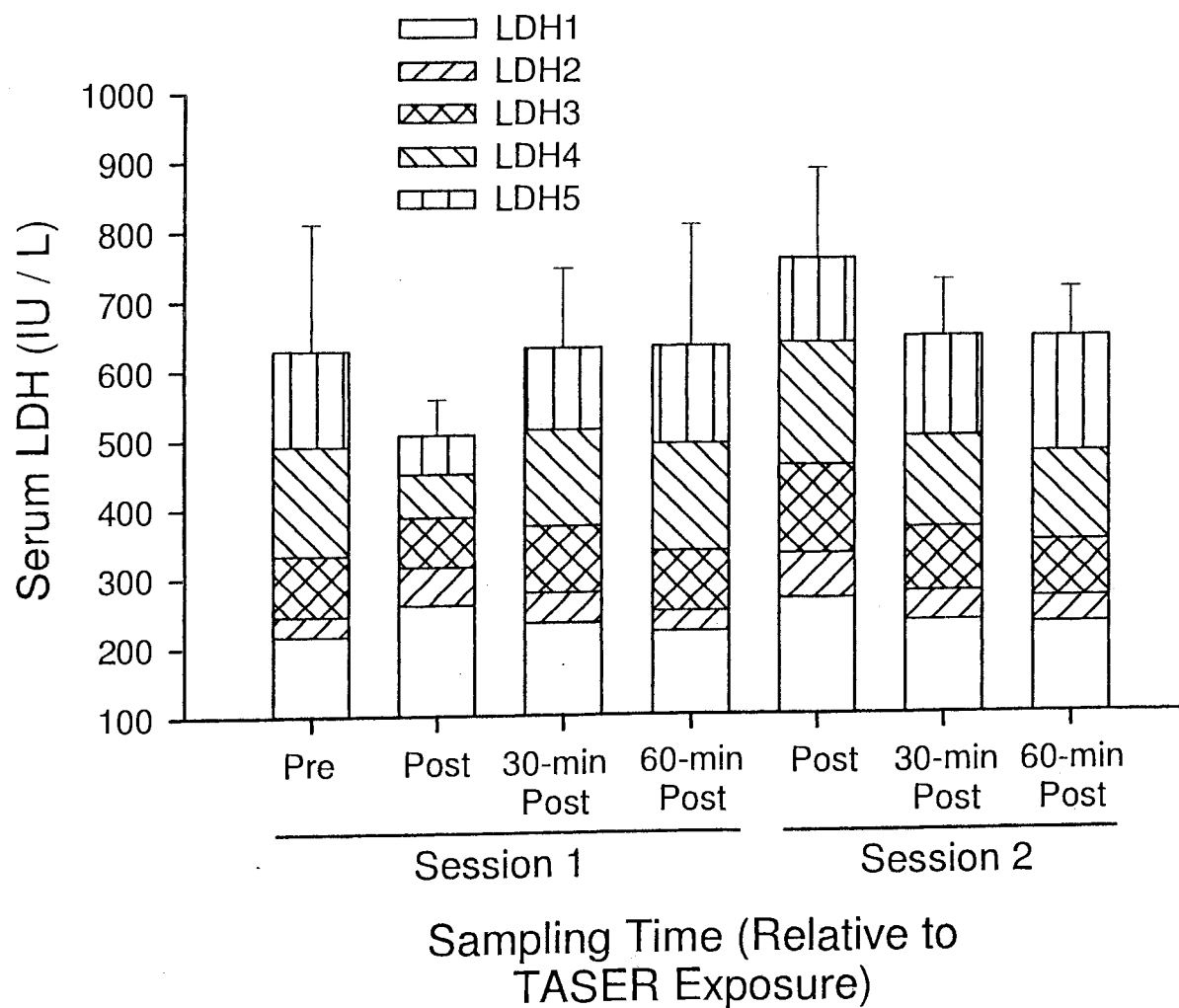
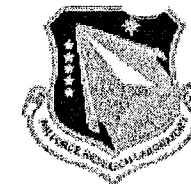


Creatine phosphokinase



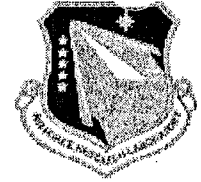


Lactate dehydrogenase





Summary of Completed Work



Behavioral:

One commercial device: Loss of **posture**.

Effectiveness related to **total charge** flux.

Variable pulse device:

Varying pulse amplitude and duration over several orders of magnitude results in increased **muscle contraction** (up to 2.5 times).

Minimum spacing of **20 cm** for maximum contraction.

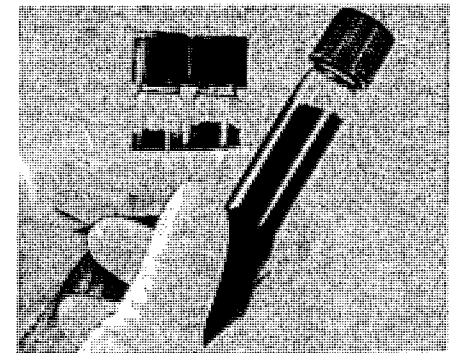
Repeated exposures:

Transient increases in potassium and sodium.

Blood **pH** significantly decreased, but returns to normal.

Lactate highly elevated; **slowly** returns to baseline.

Some **medical monitoring** of subjects may be required.



UNITED STATES OF AMERICA

Excessive and lethal force? Amnesty International's concerns about deaths and ill-treatment involving police use of tasers

Introduction and summary

"I asked Borden to lift up his foot to remove the shorts, but he was being combative and refused. I dry stunned Borden in the lower abdominal area ... We got Borden into the booking area. Borden was still combative and uncooperative. I dried [sic] stunned Borden in the buttocks area..." After the final shock, the officer "noticed that Borden was no longer responsive and his face was discoloured." (extract from officer's statement on James Borden, a mentally disturbed man being booked into an Indiana jail.)¹

James Borden was arrested in a disoriented state in November 2003 and died shortly after the administration of the last of six electro-shocks, delivered while his hands were reportedly cuffed behind his back. The medical examiner released a statement listing cause of death as a heart attack, drug intoxication and electrical shock. James Borden is one of thousands of individuals shocked with stun devices by US law enforcement agents each year as a growing number of agencies move to adopt such weapons.

More than 5,000 US law enforcement agencies are currently deploying tasers, dart-firing electro-shock weapons designed to cause instant incapacitation by delivering a 50,000 volt shock. Tasers are hand-held electronic stun guns which fire two barbed darts up to a distance of 21 feet, which remain attached to the gun by wires. The fish-hook like darts are designed to penetrate up to two inches of the target's clothing or skin and deliver a high-voltage, low amperage, electro-shock along insulated copper wires. Although they were first introduced in the 1970s, the take-up rate for tasers has increased enormously in recent years, with the marketing of powerful "new generation" models such as the M26 Advanced Taser and the Taser X26. Both fire darts which strike the subject from a distance or, as in James Borden's case, can be applied directly to the skin as a stun gun.

The manufacturers and law enforcement agencies deploying tasers maintain that they are a safer alternative to many conventional weapons in controlling dangerous or combative individuals. Some police departments claim that injuries to officers and suspects, as well as deaths from police firearms, have fallen since their introduction.

Amnesty International acknowledges the importance of developing non-lethal or "less than lethal" force options to decrease the risk of death or injury inherent in the use of firearms or other impact weapons such as batons. However, the use of stun technology in law

¹ *Idnews.com*, 20 February 2004.

enforcement raises a number of concerns for the protection of human rights. Portable and easy to use, with the capacity to inflict severe pain at the push of a button without leaving substantial marks, electro-shock weapons are particularly open to abuse by unscrupulous officials, as the organization has documented in numerous cases around the world.²

Although US law enforcement agencies stress that training and in-built product safeguards (such as chips which can record the time and date of each taser firing) minimize the potential for abuse, Amnesty International believes that these safeguards do not go far enough. There have been disturbing reports of inappropriate or abusive use of tasers in various US jurisdictions, sometimes involving repeated cycles of electro-shocks.

There is also evidence to suggest that, far from being used to avoid lethal force, many US police agencies are deploying tasers as a routine force option to subdue non-compliant or disturbed individuals who do not pose a serious danger to themselves or others. In some departments, tasers have become the most prevalent force tool. They have been used against unruly schoolchildren; unarmed mentally disturbed or intoxicated individuals; suspects fleeing minor crime scenes and people who argue with police or fail to comply immediately with a command. Cases described in this report include the stunning of a 15-year-old schoolgirl in Florida, following a dispute on a bus, and a 13-year-old girl in Arizona, who threw a book in a public library.

In many such instances, the use of electro-shock weapons appears to have violated international standards prohibiting torture or other cruel, inhuman or degrading treatment as well as standards set out under the United Nations (UN) Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials. These require that force should be used as a last resort and that officers must apply only the minimum amount of force necessary to obtain a lawful objective. They also provide that all use of force must be proportionate to the threat posed as well as designed to avoid unwarranted pain or injury.

International standards encourage the development of non-lethal incapacitating weapons for law enforcement "for use in appropriate situations, with a view to increasingly restraining the application of means capable of causing death or injury to persons" but state that such weapons must be "carefully evaluated" and their use "carefully controlled".³ Amnesty International believes that this standard has not been met with regard to tasers, despite their increasing use across the country.

Amnesty International is further concerned by the growing number of fatalities involving police tasers. Since 2001, more than 70 people are reported to have died in the USA and Canada after being struck by M26 or X26 tasers, with the numbers rising each year. While coroners have tended to attribute such deaths to other factors (such as drug

² See, for example, Amnesty International, *The Pain Merchants: Security equipment and its use in torture and other ill-treatment* (AI Index: ACT 40/008/2003)

³ Principles 2 and 3 of the *Basic Principles on the Use of Force and Firearms by Law Enforcement Officials*, Eighth United Nations Congress on the Prevention of Crime and the Treatment of Offenders, Havana, 1990 (U.N.Doc. A/CONF.144/28/Rev.1 at 112 (1990).

intoxication), some medical experts question whether the taser shocks may exacerbate a risk of heart failure in cases where persons are agitated, under the influence of drugs, or have underlying health problems such as heart disease. In at least five recent cases, coroners have found the taser directly contributed to the death, along with other factors such as drug abuse and heart disease. As discussed below, the death toll heightens Amnesty International's concern about the safety of stun weapons and the lack of rigorous, independent testing as to their medical effects.

This report includes a review by Amnesty International of information on 74 taser-involved deaths, based on a range of sources, including autopsy reports in 21 cases. Most of those who died were unarmed men who, while displaying disturbed or combative behaviour, did not appear to present a serious threat to the lives or safety of others. Yet many were subjected to extreme levels of force, including repeated taser discharges and in some cases dangerous restraint techniques such as "hogtying" (shackling an individual by the wrists and ankles behind their back). The cases raise serious concern about the overall levels of force deployed by some police agencies as well the safety of tasers.

Tasers have been described by many police departments as "filling a niche" on the force scale.⁴ However, Amnesty International is concerned that deployment of tasers, rather than minimizing the use of force, may dangerously extend the boundaries of what are considered "acceptable" levels of force. While the organization concedes that there may be limited circumstances under which tasers might be considered an alternative to deadly force, there is evidence to suggest that measures such as stricter controls and training on the use of force and firearms can be more effective in reducing unnecessary deaths or injuries (see below, page 9).

In its recommendations, contained at the end of the report, Amnesty International is reiterating its call on federal, state and local authorities and law enforcement agencies to suspend all transfers and use of electro-shock weapons, pending an urgent rigorous, independent and impartial inquiry into their use and effects.

Where US law enforcement agencies refuse to suspend tasers, the organization is recommending that their use of tasers is strictly limited to situations where the alternative under international standards would be deadly force, with detailed reporting and monitoring procedures.

⁴ Many US police departments use a "use of force continuum" setting out the appropriate force options in response to each resistance level, on a rising scale from "officer's presence" to use of deadly force.

1. GENERAL CONCERNS ABOUT TASER USE

1.2. Background on Taser Use

"I have always stated that the only way to guarantee a knockdown of a human being is to shoot them in the central nervous system with a bullet. In my opinion the ADVANCED TASER comes extremely close to doing the same thing, but from a less-lethal perspective." Sgt Darren Laur, Control Tactics Coordinator, Victoria Police Department, Canada, writing in a review article, published in the October 1999 issue of *Law Enforcement Technology*.

"It just takes your legs out. It's like a jackhammer going Kaboom, Kaboom, Kaboom!" Sgt Burt Robinson Chandler, Police SWAT team, Arizona, describing the M26 Advanced Taser on website of security equipment company, Security Planet Corp.

Named after the hero of a popular science fiction series,⁵ tasers were originally developed by a California-based company in the 1970s. The Los Angeles Police Department (LAPD) became the first major agency to introduce them in 1974. (The videotape of the LAPD beating of Rodney King in March 1991 shows an officer holding a taser gun he had fired at King, trying to keep the wires from getting tangled as King rolled on the ground from police baton blows.) Tasers have been promoted as having advantages over other non-lethal weapons as they can be applied at a distance (avoiding injury to officers) and, unlike chemical sprays, are not affected by wind and do not risk contaminating officers or bystanders. However, the earlier taser models were not always effective, especially in the case of individuals who were highly agitated or under the influence of drugs such as phenylcyclohexyl piperidine (PCP).⁶ During the 1990s, companies started to develop more powerful prototypes of the taser and other stun weapons.

Thousands of US law enforcement agencies now deploy the M26 Advanced Taser, which are several times more powerful than the original version used by the LAPD and other agencies in the 1970s and 1980s. The M26 is one of a new generation of tasers developed by Taser International, an Arizona-based company, and was introduced for operational use in late 1999. It operates on 26 watts of electrical output (compared to 5-7 watts of earlier models) and discharges pulsed energy to deliver a 50,000 volt shock designed to override the subject's central nervous system, causing uncontrollable contraction of the muscle tissue and instant collapse.⁷ In May 2003, Taser International introduced a new model, the Taser X26, which is 60% smaller and lighter than the M26 but has the same voltage and, according to the

⁵ It is an acronym of Thomas A. Swift's Electrical Rifle, based on the child's novel *Tom Swift and his Electric Rifle* by Victor Appleton, published in 1911.

⁶ Known by the alternative chemical name of Phencyclidine and a range of slang terms such as "angel dust".

⁷ The original taser operated on only 5 watts and was followed by Air Taser on 7 watts. The M18-M26 series of tasers, introduced by Taser International in 1999 and 2000, operate on 18-26 watts of electrical output.

manufacturer, an incapacitating effect which is 5% greater than the M26.⁸ Both fire two probes up to a distance of 21 feet and are programmed to be activated in five-second bursts of electricity, although, as shown below, the electrical charge can be prolonged beyond five seconds if the officer's finger remains depressed on the trigger. The shocks can also be repeated so long as both probes remain attached to the subject. The darts are fired by an air cartridge which has to be reloaded if a second firing is required. Both models have laser sights, for accurate targeting (and avoiding hitting vulnerable spots such as eyes or face). They also have a built-in memory option to record the time and date of each firing (see below for more on this).

Both the M26 and the X26 can also be used without the air cartridge, as "touch" stun guns, to apply electric shocks directly to the subject at close range. The duration of the cycle in stun gun mode is the same as in the dart projectile mode.

According to the literature, the new generation tasers are designed "...to incapacitate dangerous, combative, or high risk subjects that may be impervious to other less-lethal means, regardless of pain tolerance, drug use, or body size". They have been described as "the only less-lethal weapon that can stop a truly focused, aggressive subject" and as "specifically designed to stop even elite, aggressive, focused combatants".⁹

In meetings with Amnesty International, Taser International has stressed that, unlike earlier models, the M26 and X26 tasers are not designed to stop a target through infliction of pain but work by causing instant immobilization through muscle contraction. According to the company they are one of the few non-lethal weapons effective in causing incapacitation without physiological injury. They have pointed out that any pain involved is transient, with no after-effects. However, officers subjected to even a fraction of the normal taser discharge during training have reported feeling acute pain:

"Bjornstad, who was jolted for 1.5 seconds as part of his training, said all of his muscles contracted and the shock was like a finger in a light socket many times over. "Anyone who has experienced it will remember it forever ... You don't want to do this. It's very uncomfortable ... and that's an understatement." (*The Olympian*, 14 October 2002)

"It's like getting punched 100 times in a row, but once it's off, you are back to normal again." (*The Olympian* 2 March 2002)F

"It felt terrible." "It hurts. I'm going to think twice before I use this on anyone." (two officers quoted in the *Mobile Register* 8 April 2002).

⁸ According to company literature, the X26 is 5% more incapacitating than the M26 while using less energy, due to its advanced Shaped Pulse Technology which sends the hardest, high voltage, short duration, pulsed energy for the first two seconds, when the darts penetrate clothing, skin or other barriers, with a reduced rate for the rest of the hit.

⁹ Taser International literature.

"It is the most profound pain I have ever felt. You get total compliance because they don't want that pain again." (firearms consultant, quoted in *The Associated Press* 12 August 2003)

"They call it the longest five seconds of their life ... it's extreme pain, there's no question about it. No one would want to get hit by it a second time." (County Sheriff, quoted in *The Kalazazoo Gazette*, Michigan, 7 March 2004)

Officers were initially exposed during training to only a fraction of the normal taser discharge of five seconds, yet still testified to experiencing considerable pain. Amnesty International understands that it is now recommended that officers are subjected to a five-second shock, although at least one department no longer allows officers to be tasered at all during training, following complaints from officers.¹⁰ While the pain is short-lived, this would not necessarily apply in the case of someone subjected to repeated or prolonged jolts of the taser darts or stun gun (see below). Amnesty International has been told by an expert who has experienced shocks from both models that the X26 model is even more painful than the M26.

Unlike the dart-firing probes, the touch stun function only acts on a small part of the body, and causes pain and debilitation rather than total incapacitation. A Taser International training manual states that "If only the stun mode is used, the M26 becomes a pain compliance technique..."¹¹ The advice given in the manual for "stun mode areas" is to "aggressively drive M26 into:

- Carotid/brachial stun area¹²
- Groin
- Common Peroneal¹³."

Although, as stated above, the M26 and X26 tasers are programmed to set off an automatic five-second electrical charge, this happens if an officer pulls the trigger and releases it. The electrical charge can be prolonged beyond five seconds if the officer keeps his finger depressed on the trigger. A Taser International training manual states that "holding the trigger continuously beyond the 5 second cycle will continue the electrical cycle until the trigger is released". The following testimony was given by a police training officer at an inquest into the death of William Lomax, who had a taser in stun gun mode applied repeatedly to his neck in jolts lasting up to eight seconds each:

"if you hold the trigger down, it will go until the battery life runs out of the taser (sic)."

¹⁰ According to testimony at the inquest into the death of William Lomax on 25 June 2004, the Las Vegas Metropolitan Police Department stopped having officers "taze" each other during training after complaints from officers about having to take a "hit" and complaints about injuries from falling.

¹¹ Taser International, *Certified Lesson Plan, Version 8.0, Advanced Taser M26*.

¹² Neck and arm

¹³ Outer thigh

Juror: So it will go continuously until you let go?

Witness: correct."¹⁴

1. 3 Deployment of tasers in the USA: life saver or routine force tool?

More than 5,000 law enforcement and correctional agencies in 49 US states are currently reported to be deploying or testing taser equipment, with the take-up rate continuing to grow, reportedly by around 170 police agencies a month. Several US states which formerly banned all stun weapons have recently changed their laws to allow local and state police to deploy tasers.¹⁵ In some states they are deployed by police on university campuses and they have also been used in schools (see below).

Tasers have also been purchased by the US army, including for use in Iraq.¹⁶ The US Air Force also reportedly deploys tasers aboard aircraft carrying suspected al-Qa'ida members to Guantánamo Bay, Cuba.¹⁷ While few details have been provided about the use of tasers by US military forces, one of the units deploying them in Iraq in 2003 was the 800th Military Police Brigade, accused of grave abuses in Abu Ghraib prison.¹⁸

New generation tasers have also been purchased, or are undergoing testing, by police or military forces in other countries, including, reportedly, Argentina, Australia, Canada, France, Germany, Israel, Malaysia, Mexico, Spain, Turkey, the United Arab Emirates and the UK.¹⁹

¹⁴ From transcript of inquest proceedings in case of William Lomax, Las Vegas, Nevada, 25 June 2004 (see more on this case under **Deaths in Custody**, below).

¹⁵ In Michigan the law was changed in December 2002 to legalize tasers for law enforcement use only, since when more than 100 police agencies in the state have begun using them. Massachusetts became the most recent state to pass similar legislation in July 2004, leaving New Jersey as the only state still banning their use in all circumstances.

¹⁶ Taser International announced in June 2004 that it had won a \$1.8 million contract to provide stun weapons to US military personnel, following a previous smaller order by the U.S. Army for stun guns and tasers for use in Iraq. (AP, 30 June 2004).

¹⁷ Aviation Daily, 2 August 2002 (available at: www.taser.com/aviation/aviation02.html)

¹⁸ "US issuing troops more 'non-lethal' weaponry", *Chicago Tribune*, 11 December 2003, citing a report from retired Lt Col Wesley Barbour that members of the 800th Brigade used lethal force several times to quell detainee uprisings but that such rebellions ended after police "demonstrated" the power of the taser. A report by Major-General Antonio Taguba in December 2003 found members of the 800th Brigade were among US forces which had engaged in "sadistic, blatant and wanton" abuse of detainees in Abu Ghraib Prison in 2003 [http://news/findlaw.com/hdocs/Iraq/tagubarpt/html](http://news.findlaw.com/hdocs/Iraq/tagubarpt/html).

¹⁹ See Appendix 2 for a list of countries reported to have deployed, tested or trialled tasers, or have taser distributors based there. Amnesty International obtained the information from various sources, including Taser International's website listing distributors.

Tasers have also been authorized for use by the general public. Forty-three US states are reported to place few or no restrictions on possession of stun weapons by members of the public for private use.²⁰ While promoted as self-defence tools, for private users, they are easily open to abuse, without the controls or monitoring that apply to law enforcement use. Amnesty International cites several cases, below, in which parents have been prosecuted for child cruelty after using stun weapons to discipline their children. Stun weapons have also been reportedly used during the commission of crimes, or as instruments of torture or abuse, including of women by abusive partners or former partners.

Amnesty International is opposed to the sale of stun weapons for private use, given the difficulty in ensuring adequate standards of monitoring and control and the potential for abuse behind closed doors. While police officers undergo training and are subject to regulations governing the use of force, no such controls exist for the private sector. Unlike firearms, there are no licensing requirements in the USA for private use of tasers.²¹

The latest model for private use in the USA is the Taser X26c Citizen Defense System, which was introduced for sale on-line through Taser International in September 2004. According to company literature, the Taser X26c, which can also be used as a stun gun, has a 15 feet stand-off capability and “operates at a slightly lower output than the law enforcement Taser X26”. Disturbingly, it also operates “with an extended duration of up to 30 seconds per discharge”.²²

In the UK, modern tasers have since 2003 been deployed by a number of police departments under the same strict guidelines as apply to firearms. They are allowed to be used only by authorized firearms officers, are kept in the firearms box and are issued only in appropriate situations where officers are faced with a threat of deadly force and the only other option would be use of a conventional firearm.

In the USA, tasers are authorized for use in much broader circumstances, as discussed below. Nevertheless, they are promoted in the USA, as elsewhere, as an important tool in saving lives and reducing the need for lethal force. Under international standards, lethal force may only be used by officers in self-defence or the defence of others when there is an imminent threat of death or serious injury, and “only when less extreme measures are insufficient to achieve these objectives”.²³

²⁰ Tasers are barred for citizen use in seven US states: Massachusetts, Rhode Island, New York, New Jersey, Wisconsin, Michigan and Hawaii, and in certain cities and counties.

²¹ Because tasers use compressed air or gas instead of gunpowder to propel the darts, tasers are not considered as firearms and do not fall under the regulation of the Federal Bureau of Alcohol, Tobacco or Firearms.

²² Taser International press release, 15 September 2004. The release states that the extended discharge is in order to allow the user “sufficient time to safely get away from a potentially life-threatening situation”. The company reports that private citizens who purchase the device will receive a 40 minute training video and a coupon redeemable for a one-hour in-home training course from a local law enforcement officer trained in taser use.

²³ Principle 9 of the *Basic Principles on the Use of Force and Firearms by Law Enforcement Officials*

Taser International has repeatedly emphasized in statements and literature how taser use has saved lives. For example, in July 2004, the company issued a statement citing a case in which a woman advancing on officers with an eight-inch knife had been successfully disarmed with a taser rather than shot with a firearm and another case where a suicidal man threatening to cut his own throat was similarly disarmed without injury. The company stated that it had received "over 500 similar reports where officers have used the TASER to save a life", estimating that the true figure was likely to exceed 5,000 cases.²⁴ Claims that tasers save lives may, however, include incidents involving intervention at an earlier stage than a situation posing an imminent threat of death or serious injury. Taser International states in a lesson plan for US law enforcement agencies that:

"The Advanced Taser is not a substitute for lethal force. However, many situations that begin as standoffs have the potential to escalate to lethal force. Early, aggressive use of a less-lethal weapon like the M26 can prevent many of these situations from escalating to deadly force levels".²⁵

Some police departments have reported a significant fall in police shootings following the introduction of tasers. In February 2004, the Phoenix Police Department, Arizona, announced that officer-involved shootings had fallen by 54% from 28 in 2002 to 13 in 2003, with fatal shootings down from 13 to 9 during the same period, the lowest number since 1990. Phoenix Mayor Phil Gordon said "I am proud that Phoenix is the first city in the nation to equip all of our police officers with tasers. We are committed to providing our officers with the latest technology, support and equipment that they need in order to protect them and the community."²⁶ A Taser International brochure reported that use of firearms and impact weapons by Orange County (Florida) sheriff's deputies fell by 80% following the introduction of the Advanced Taser in 2000, "reducing injuries and saving lives".²⁷

Reports of a fall in police shootings in the cities of Seattle and Miami have similarly been attributed, at least in part, to the introduction of tasers. Both police departments reported no fatal police shootings for the first time more than a decade in the year tasers were introduced – in Miami's case there were no police shootings, fatal or otherwise, for the first time in 14 years.²⁸ Other departments have reported on specific instances where officers have used tasers instead of firearms to disarm suicidal or mentally ill individuals armed with

²⁴ "Taser International Strongly Refutes New York Times Article", statement from Taser International July 2004, following a critical article in the *New York Times*. The statement cites company estimates that less than one in ten police reports on such incidents are received and that "Accordingly, we conservatively estimate that there are over 5,000 such incidents where the TASER has saved a life or averted serious bodily injury".

²⁵ From a Taser International lesson plan on the M26 Advanced Taser.

²⁶ City of Phoenix Police Department news release, 6 February 2004

²⁷ www.taser.com/pdfs/m26brochure.pdf

²⁸ "As Shocks Replace Police Bullets, Deaths Drop but Questions Arise", *New York Times* 7 March 2004 – no-one was shot and killed in Seattle for the first time in 15 years. In Miami there were no police shootings, fatal or otherwise, in 2003, for the first time in 14 years.

weapons such as knives, although reports of officers using tasers when confronted with people with guns appear to be much rarer.

Amnesty International welcomes any reduction in the use of lethal force. However, claims that tasers have led to a fall in police shootings need to be put into perspective, given that shootings constitute only a small percentage of all police use of force. In contrast, taser usage has increased dramatically, becoming the most prevalent force option in some departments. While police shootings in Phoenix fell from 28 to 13 in 2003, tasers were used that year in 354 use-of-force incidents, far more than would be needed to avoid a resort to lethal force.

Use of non-lethal weapons may be only one factor leading to a fall in police shootings and other serious force. In Miami, for example, the fall in officer-involved shootings may be due in part to greater oversight following several high profile prosecutions of Miami police officers for civil rights violations involving wrongful shootings and an ongoing federal Justice Department investigation into an alleged pattern of excessive force.²⁹

Representatives of Taser International who met with Amnesty International in July 2004 said there had been a significant reduction in injuries to suspects and officers following the introduction of tasers, according to police reports of operational use across the USA. The company noted that many other types of force, such as use of batons or police dogs resulted in higher injury levels than the taser. It was stressed that a reduction in injuries was likely to be more pronounced where tasers were used below the level justifying lethal force as all use of physical force, including light hands-on force, could result in some bodily injury.

However, as shown below, many departments allow officers to use tasers in situations that would not justify the use of batons or other impact weapons liable to cause serious injury. Reports suggest that, in some departments, tasers are used by officers primarily as a substitute for pepper or chemical sprays, which may themselves be considered a relatively low-level force option. Amnesty International has frequently raised concern about alleged misuse of pepper spray by law enforcement officers, including its use in situations that do not merit this degree of force.³⁰ The organization suggests that, rather than substituting electro-shock weapons for pepper spray or other force options, better training and restraint in the use of force would be a more appropriate strategy in many situations.

²⁹ Indeed, in a letter to the Miami City Attorney, dated 13 March 2003, the Justice Department expressed concern that the Miami Police Department's policy on tasers was insufficiently stringent, noting that it failed to define what constituted a reasonable use of force or to place tasers on a "use of force continuum". The Justice Department recommended the introduction of a force continuum as a valuable tool which "emphasizes that an officer's presence, verbal commands and use of soft hands techniques (using hands to escort rather than control) can often be used as an alternative to other, more significant, uses of force."

³⁰ There have been many reported instances of abusive use of pepper spray and chemical sprays by US law enforcement officials against people in police custody, in prisons and in juvenile detention facilities, including their use as a front line of control in the case of individuals who fail to comply immediately with orders. Complaints have been documented in lawsuits, by civil liberties and police monitoring bodies, and in Amnesty International reports.

Indeed, improved policies, training and oversight have been shown to be critical factors in reducing police shootings and injuries to suspects or officers. Such measures are likely to have a more significant impact overall than use of alternative weapons. In San Jose, California, for example, the police department obtained its first sizeable batch of new tasers in 2002, a year in which police shootings fell to zero. However, police shootings in San Jose had been falling since 1999, a development attributed in large part to better training on the use of force; the introduction of a Crisis Intervention Team (CIT) to defuse potentially dangerous situations involving disturbed individuals; and an independent auditor to monitor the department. Improved use-of-force policies, investigations and training led to a fall in police shootings and dog bite injuries in Washington, DC, where the Metropolitan Police Department (MPD) was once notorious for its high rate of officer-involved-shootings and injuries to suspects from police canines.³¹ Other departments, including the Los Angeles Police Department (LAPD) and the Los Angeles Sheriff's Department (LASD), have noted similar trends.³²

In fact, in San Jose, police shootings started to rise again after the introduction of tasers (which were issued to all patrol officers in May 2004), reaching a five-year high in 2004.³³ Their effectiveness in resolving use-of-force situations has been questioned by the San Jose Independent Police Auditor, who announced a review of the department's taser use in September 2004, following concern about two incidents in which police shot disturbed individuals after tasers failed to subdue them.³⁴ One case concerned a mentally disturbed man who became agitated after being asked to stop smoking in a coffee shop and allegedly threw a chair at officers. He was shot after the taser failed to subdue him. Questions have been raised as to whether other force tactics might have been more safely deployed in such a situation.

³¹ Justice Department press release on the MPD, dated June 2001: "In the past two years ... MPD has achieved a significant reduction in the rate at which it uses deadly force and the rate at which its canines bite suspects". Officer-involved-shootings fell from 16 fatalities in 1990 to four in 1999 and two in 2000. The MPD did not have tasers at that time.

³² In the LAPD, for example, police shootings and total use-of-force incidents decreased significantly between 1990 and 1999, during a period in which an independent monitor noted that there were "better investigations, better oversight, greater scrutiny on the use of force" than ever before (former Inspector General Jeff Eglash, quoted in *L.A. Weekly*, September 2002). The LASD saw police shootings fall by 70% from 1991 to 2000, during a period in which the number of arrests remained constant. The Special Monitor appointed to oversee the department reported in 2003 that that "excessive force has been substantially curbed", and that better reporting and monitoring had contributed to this trend. *Civilian Oversight of the Police in the United States*, Merrick Bobb, September 2002.

³³ There were eight police shootings in San Jose in 1999; five in 2000; four in 2001; zero in 2002; four in 2003 and six in the first nine months of 2004. (1999-2003 statistics from IPA 2003 Report.)

³⁴ "Police to review use of stun gun", *Mercury News*, 29 September 2004

1. 4 Low on the force scale

Although described by the manufacturer as a suitable tool for “aggressive, focused combatants”, the taser appears to be a relatively low level force option in many US police departments. A survey by Amnesty International of more than 30 US police departments (including 20 of the largest city or county agencies) indicates that tasers are typically placed in the mid-range of the force scale, *below* batons or impact weapons rather than at, or just below, lethal force.³⁵ Some departments place the entry level for tasers at an even lower level, after verbal commands and light hands-on force.

For example, a number of law enforcement agencies allow tasers to be used against “passive resisters” – people who refuse to comply with police commands but do not interfere with an officer and pose no physical threat.³⁶ Others authorize tasers at an entry level of “defensive resistance”, typically defined as “physical actions which attempt to prevent officer’s control but do not attempt to harm the officer”.³⁷ The Miramar Police Department, Florida, told Amnesty International (in response to concerns raised about the stunning of a schoolgirl during a minor disturbance) that tasers were available “prior to the use of intermediate weapons” such as batons. A Philadelphia Police Department directive states that tasers may be used, among other scenarios, to “overcome resistance to arrest”. Indianapolis police told Amnesty International that the entry level at which tasers could be used was “at any point force is needed”.³⁸ While many departments authorize tasers at the level of “active physical resistance”, according to a number of policies Amnesty International has seen, this can be in the form of “bracing or tensing” or “attempts to push or pull away”. These scenarios hardly depict the “combative” or “aggressive” individuals described in promotional literature.

Amnesty International believes that electro-shock weapons, which have a powerful impact on the body and can cause acute pain, should never be considered a “low” or “intermediate” force option. However, a review of reported cases suggests that some departments are deploying tasers in routine arrest situations, at the first sign of resistance or in

³⁵ The mid-range on the force continuum is generally where pepper or chemical sprays are placed.

Taser International told Amnesty International that 86% of US agencies placed tasers at this level.

³⁶ Several police departments have recently changed their policies to raise the entry level for taser use from “passive” to “active” resistance following controversial cases. These include 11 police agencies in Orange County, Florida. Other departments reportedly continue to authorize such use, either in a written policy or in practice (they include the Honolulu Police Department, Hawaii; the Portland Police Department, Oregon, which is reported to allow taser use against people who are non-compliant but not a physical threat; several agencies in Colorado are also reported, in practice, to have used tasers against people passively resisting arrest, or refusing to obey a police order.)

³⁷ Examples include the Mesa Police Department, Arizona; the Chula Vista Police Department, California and the Putnam County Sheriff’s Office, Florida.

³⁸ Telephone interview, March 2004

the face of relatively minor resistance. Incidents include cases of people under the influence of alcohol or drugs who failed to comply promptly with commands, people who “mouthed off” at officers and people engaged in minor acts of public disturbance. The use of electro-shock weapons in such circumstances appear to breach international standards set out under the UN Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms. These require that force should be used only as a last resort, in proportion to the threat posed and the legitimate objective to be achieved.³⁹

Training materials on tasers suggest that they are safe to use against a wide age range and that repeated shocks pose no additional risks. Confidence in such claims may explain why there are reports of tasers being used against elderly people and children, and of people being subjected to multiple shocks. Tasers have also been used to subdue unarmed mentally ill or disturbed individuals who were not committing a crime or posing a threat of serious injury. Given the pain and the psychological impact or fear caused by being stunned or threatened with an electro-shock weapon, the use or threat of tasers in these and other cases, even without physical injury, may constitute torture or other cruel, inhuman or degrading treatment.

The USA has ratified the UN Convention against Torture and the International Covenant on Civil and Political Rights (ICCPR), both of which prohibit torture and other cruel, inhuman or degrading treatment or punishment. The UN Human Rights Committee, the expert body which monitors compliance with the ICCPR, states that “the aim of the provisions of article 7 of the International Covenant on Civil and Political Rights is to protect both the dignity and the physical and mental integrity of the individual”. The Committee emphasises that the prohibition of torture or cruel, inhuman or degrading treatment or punishment in article 7 “relates not only to acts that cause physical pain but also to acts that cause mental suffering to the victim.”⁴⁰

The following accounts, based on press articles, police reports and other sources, illustrate Amnesty International’s concerns about the way tasers have been used in various US jurisdictions.

Florida

Local police agencies in Florida were among the first to adopt the new generation tasers on a wide scale. Twelve (nearly one in five) of the recent US taser-related deaths discussed under Chapter 2 occurred in Florida, with four in Orange County alone. In addition to those cases, Florida police have reportedly used tasers to subdue:

³⁹ “Law enforcement officials may use force only when strictly necessary and to the extent required for the performance of their duty” (Article 2, *UN Code of Conduct for Law Enforcement Officials*); “Law enforcement officials, in carrying out their duty, shall, as far as possible, use non-violent means before resorting to the use of force and firearms...” and should “exercise restraint in such use and act in proportion to the seriousness of the offence and the legitimate objective to be pursued” (Articles 5 and 5(a) of the *Basic Principles on the Use of Force and Firearms by Law Enforcement Officials*.

⁴⁰ General Comment 20, 10 April 1992

- a man who refused to be fingerprinted and wrestled and shoved officers (Pembroke Pines Police Department, Broward County)
- a woman who interrupted a seminar at a country club and pushed officers away, shouting that they were “sick with demons” (Pembroke Pines Police Department)
- a man who refused to discard the drink he was drinking in a park and refused to turn round and be handcuffed (Orange County Sheriff’s Office)
- a woman who, ordered out of a pool for swimming naked and once dressed, refused repeated commands to turn round and put her hands behind her back. (Orange County Sheriff’s Office)
- a 15-year-old schoolgirl, who was tasered and pepper sprayed after arguing with officers after she and other children were put off a bus during a disturbance. (Miramar Police Department, Broward County)
- a 14-year-old schoolgirl who was tasered after fighting with a school “resource officer” in a classroom. The officer first used the taser as a “stun gun” applying it directly to her chest; when she continued to struggle he deployed the “air cartridge” twice before she was handcuffed. (Putnam County Sheriff’s Office)⁴¹

In May 2004, the city of Melbourne, Brevard County, Florida, announced a review of police taser use after reports that officers had fired two tasers simultaneously at an unarmed 23-year-old man who had turned his back on officers when they called at his house to investigate a neighbour’s complaint about loud rap music. He was allegedly jolted multiple times, causing acute pain. A study of police incident reports conducted by a local newspaper found that Melbourne police had used tasers against 75 people in 18 months, most of whom were unarmed.⁴² They included

- a 14-year-old boy who had allegedly broken a window and tried to run away;
- a 50-year-old man who refused to give police his date of birth during a disturbance at a picnic;
- a woman jolted at least five times with a taser as an officer held her down.

In most or all of the cases cited above, the use of force was found to be in accordance with departmental policies. In the case of the 14-year-old tasered in the classroom, the Putnam County Sheriff’s Office informed Amnesty International that “use of the taser in this instance is in accordance with agency policy”, noting that the girl in question, who weighed 221 lbs (100 Kg), had a history of assaultive behaviour at the school. While recognizing the

⁴¹ Sources include: *Miami Herald* 14 April 2002; *Orlando Sentinel* 4 August 2002; Miramar Police Department; WJXT News4-Jax.com, 8 January 2004; Putnam County Sheriff’s Office, March 2004.

⁴² Report by J.D. Gallop, *Florida Today*, June 2004

challenges posed by such behaviour, Amnesty International remains concerned at the use of an electro-shock weapon against a disturbed, unarmed teenager.

In July 2004, it was announced that eleven police agencies in Orange County, Florida, had agreed to restrict their use of tasers following a year-long review which suggested that some officers were too quick to resort to their weapons. Before the restrictions were imposed, officers were permitted to shock anyone who prevented an officer "from taking lawful action", including people engaged in "passive resistance": those who disobeyed an officer's verbal command without engaging in any threat or act of physical harm. The new rules allow officers to stun only people who show "active resistance". However, tasers can still be used well below the "lethal force" level, including under such broad circumstances as "preventing an officer from making an arrest". Some US police agencies may continue to allow tasers to be used at the level of "passive resistance". Records from the Orange County Sheriff's Department, Florida (the largest county police agency), showed that the agency used tasers in 180 cases in which individuals were engaged in "passive resistance" from 2001 to October 2003, although this policy was reportedly under review.⁴³

Colorado

A study by the Denver Post in May 2004 found that the Denver Police Department, Colorado, commonly used tasers against people who refused to submit to handcuffing or who walked or ran away from police officers. In 90% of cases the subjects were unarmed, and most were cited for minor offences. While in some cases tasers had been used to stop dangerous suspects and disarm the suicidal, they were more often used to force people to obey police commands and to shortcut confrontations. The study found that officers had tasered at least sixteen people who were already handcuffed, and sixteen juveniles (details of the latter cases were unavailable due to their age).⁴⁴ Most such usage was found to be within the official policy.

The Denver Police Department is one of more than 100 law enforcement agencies in Colorado to have adopted tasers and, by August 2003, had purchased enough X26 and M26 tasers to have one in every patrol car.

The Denver Post study was prompted by concerns raised by the American Civil Liberties Union (ACLU) of Colorado about inappropriate and abusive use of tasers by a number of local police and county agencies, including two cases where suspects died.⁴⁵ In several cases police subjected people to repeated shocks, sometimes while they were already restrained; other cases included people abused in local jails (see below). In many instances the accounts were corroborated by police reports. One of the cases taken up by the ACLU was

⁴³ Source: from statistics in an Orange County Sheriff's Department document dated October 15, 2003, under heading *Orange County Use of Force Successes*. The taser was most widely used in cases of "Active Physical Resistance", a level below "Aggressive Physical Resistance".

⁴⁴ Police Tasers set to stun, by David Migoya, Denver Post 4 May 2004; the study was based on a review of court and police records.

⁴⁵ Concerns outlined in a 10-page letter dated 26 February 2004 to Gerry Whitman, Chief of Denver Police Department, from Mark Silverstein, Legal Director, ACLU of Colorado

that of a man who died after being tasered at least five times by Glendale police officers as he lay supine on the floor of his room in a drug-induced stupor (see Glenn Leyba case, chapter 2 below). Other cases involving the Glendale Police Department included the following:

- A man who was drunk and verbally abusive was tasered in the back for struggling while police applied handcuffs as he lay on the ground. He was given another jolt of electricity when he continued to resist as police walked him to a patrol car.
- Police tried to arrest a man for allegedly assaulting his girlfriend in the street. The man ran away and an officer followed him slowly in her police vehicle and told him to "Stop running or I am going to Tase you", before reaching out of her vehicle, while steering it with one hand, and firing the taser at him. The man fell to the ground and was tasered again when he tried to stand up.
- A man escorted from a restaurant by police officers was touch stunned in the leg for "refusing to obey verbal commands".

In September 2004, the Denver Police Department's Chief of Police, Gerry Whitman, announced that he had changed the department's use-of-force policy to allow officers to use a taser only on suspects exhibiting "active aggression" or "aggravated active aggression". Previously, about 20% of the department's taser incidents involved police responses to the lower standard of "defensive resistance" by a suspect. Under the department's policy, "active aggression" is defined as an assault or imminent assault, while "aggravated active aggression" constitutes more serious violence that could, in some cases, justify deadly force.

However, a report published by the Denver Post on 20 September 2004 found that policies among Colorado law enforcement agencies varied widely and that in some jurisdictions police continued to "shock suspects who do little more than mouth off, pull an arm away from a handcuff, run or refuse to obey an officer's orders quickly". In three local departments – Longmont, Pueblo and Glendale – police had used tasers at a rate, on average, nearly four times greater than in Denver. The article cited cases in which suspects were subjected to repeated jolts or shocked while they were handcuffed. In one case, Commerce City Police Department officers used a taser on an allegedly drunken man seven times as they tried to take him to a detoxification centre; six of the electro-shocks were administered while he was in handcuffs. Of more than 500 cases reviewed by the Post from 15 local police agencies, only two were deemed by the departments concerned to have been inappropriate.

Portland, Oregon

An investigation by a weekly journal, *Willamette Week* (WW), into taser use by the Portland Police Department, Oregon, published in February 2004, reported that, over a 19 month period, officers had deployed tasers in more than 400 cases, including on 25 people who were already in handcuffs.⁴⁶ The WW report, which was based on a review of police incident reports, stated that "numerous potentially lethal situations" had been averted using the taser,

⁴⁶ Series of articles by Nick Budnick, appearing in the *Willamette Week*, Portland Oregon, on 4, 11 and 18 February 2004

including suicidal individuals trying to force the police to kill them.⁴⁷ However, the WW also reported on incidents in which tasers were used against people who were not a serious threat but were merely verbally abusive or failed to comply with police commands. According to the newspaper, Oregon police had tasered people “after stopping them for non-violent offenses, such as littering and jaywalking, selling plastic flowers without a license, and failing to go away when told to”. Police also used tasers on two 71-year-olds, one a woman who was blind in one eye, and the other a man who was trying to restrain a knife-wielding woman. The elderly man was shot with the taser after dropping onto his hands and knees instead of lying flat on the floor, as ordered by police. (See under **Lawsuits**, below, for details of the 71-year-old woman).

The paper also reported on the case of 20-year-old Dontae Marks, a bystander who protested when police tried to arrest a friend for being drunk outside a night-club. Police reportedly pointed a taser at Marks’ chest when he refused an order to leave, then tasered him in the back as he walked away shouting an obscenity. Six officers then reportedly grappled with him in a struggle in which Marks was pepper-sprayed and touch-stunned at least ten times while lying face-down on the ground. He was reported to have sustained 13 taser burn marks across his back, neck, buttocks and the rear of his legs. He was later acquitted on charges of affray and has filed a lawsuit. According to the WW report, an internal police review found the taser use to be justified.

Dontae Marks’ attorney is quoted as saying “They went straight for the Taser because it was quick and easy for them. He was doing what they wanted him to do, but because they didn’t believe him, they tased him. And that’s what blew the situation up.” The following incidents were also cited in the article. All were reportedly found to be within police departmental policy.

- An 18-year-old was tasered when he told police responding to an under-age drinking party to “get the f...out of my house”. He was tasered again when, after complying with an order to put his hands up, his hands started to drop.
- A driver pulled over on a bridge, angry that his car was being towed away for lack of insurance, was tased after repeatedly complaining and turning his head and body towards an officer.
- A woman who fell asleep in her parked car was tasered when officers woke her up when they opened her car door and, according to the police report, she glared at them and reached for her pocket. According to the WW review, police reports were inconsistent as to whether or not she was warned before the taser was used.

The Portland Police Department subsequently reviewed its taser use, finding that out of 595 uses since a pilot project began in July 2002, only one had been ruled out of policy.⁴⁸ In

⁴⁷ Widely reported incidents, often called “suicide by cop”, in which deranged individuals brandishing weapons allegedly goad officers into shooting them.

⁴⁸ Information attributed to Training Captain Mike Crebs, reported in *Oregonlive.com*, 24 May 2004.

May 2004, Portland Police Chief Derrick Foxworth reported to the city commissioners that the department would introduce stricter policies and training on taser use. The new policies would reportedly continue to allow officers to use tasers against handcuffed suspects but would instruct officers to consider other methods of control before stunning children, pregnant women and the elderly. At the time of writing, plans were underway to expand the deployment of tasers in the Portland Police Department, by issuing one to every patrol officer.

Chandler, Arizona

The Chandler Police Department, Arizona, is one of several agencies to have compiled detailed statistics about its taser use in a publicly available report.⁴⁹ The report documented 86 uses of the taser from April through December 2003, 42 of which involved police firing darts at suspects. In 17 cases the taser was used in touch stun mode and in five cases both the probe deployment and touch stun mode were used.⁵⁰ There were also 24 incidents in which the taser was used in Display Mode only. 97% of dart or stun deployments were in response to "active physical resistance" or higher on the force scale. "Active physical resistance" is defined in departmental policy as "acts of fleeing or escaping" or "suspect attempts to resist arrest without assaulting officer".

The report included a summary of each incident. Most of the incidents involved unarmed suspects who were reportedly engaged in aggressive or disorderly behaviour, and were resisting arrest; many occurred after or during a police chase. A breakdown of taser usage by "call type" (incident to which the police responded) showed that most police responses were to reports of domestic violence (19% of cases), followed by "suicide attempt" (13%). Others ranged from minor offenses to burglary. There is no indication that any of the incidents were found to violate the Chandler Police Department policy. The reports included use of tasers to subdue:

- a female driver of a stolen vehicle being followed by police who, after she crashed the car and fled on foot and was caught by officers, "would not comply with verbal commands and made a move towards her waistband".
- A trespassing suspect who was tasered when he "resisted being handcuffed".
- a female suspect who had broken into her grandfather's apartment and was tasered when she "attempted to walk away from the officer" and "pulled away" when he tried to stop her. The taser was applied five additional times before other officers arrived on the scene.
- a burglary suspect hiding in an attic when he "refused to comply with commands".
- a suspect who, stopped for driving with a suspended license, ran away from police.
- an autistic teenager after he assaulted his mother and wrestled an officer to the ground.

⁴⁹ Chandler Police Department: *Advanced Taser Use of Force, 2003 Annual Report*, published February 2004.

⁵⁰ Tasers were added to every Chandler officer's arsenal in May 2003

- a man standing on the sidewalk yelling and screaming at the sky. He was threatened with the taser if he did not comply with police commands to be quiet. He refused to comply and the taser was then deployed. The taser was effective but "as the subject began to get up, the taser was cycled a second time".
- A thirteen-year-old girl was tasered in a public library after she threw a book at someone and was "yelling obscenities". The case summary states: "The juvenile continued to be verbally disruptive and resisted when officers attempted to place her under arrest. The Taser was displayed and threatened. The juvenile continued to resist by curling into a ball. As the juvenile was preparing to kick at the officer, she was touch-stunned in the middle of her back".⁵¹

The Chandler Police Department study reported on 17 instances in which the taser was used solely as a touch stun gun. In most of the cases, it appears to have been used in order to gain compliance and included the following cases:

- An "out-of-control" high school student "continued to resist in the patrol car". The Taser was used on the leg as a touch stun to gain compliance.
- A suspect was stopped for "driving under the influence" and refused to comply with commands to place his hands behind his back to be handcuffed. The taser was displayed and he started to comply but placed his hands against his chest. The taser was then used in touch stun mode.
- During another arrest for "illegal consumption of alcohol", the "suspect resisted and the Taser was used in touch stun mode to gain compliance".
- The stun gun was used to gain compliance from a suspect in custody who was refusing to have blood drawn as per a court order. The taser was used a total of four times against the suspect.

Seattle, Washington

The Seattle Police Department (SPD) has issued two reports reviewing the first three years of the department's use of the M26 Advanced Taser: from January 2001 through December 2003.⁵² During this period, the department recorded 428 taser applications. The SPD reported that tasers were used in a "wide variety of incidents", with "violent crimes and drug/alcohol incidents" together comprising nearly 40% of the situations in which tasers have been used. In only 23% of cases were the taser subjects armed, mostly with knives. Nearly two-thirds of taser subjects (65%) were impaired, often severely, by alcohol, drugs or a mental illness or delusion. The reports cite instances in which lives were saved through police use of tasers against armed, mentally impaired, individuals. In other cases the subjects

⁵¹ A 15-member Citizen Review Panel ruled unanimously in January 2004 that use of the taser in this case, which occurred in September 2003, was within policy and did not constitute excessive force.

⁵² SDP Special Reports: The M26 Taser, Two Years' Experience, March 2003; SPD Taser Use 2001-2003 Key Findings, May 2004.

did not appear to have engaged in life-threatening behaviour, but were combative or disturbed. Some of the incidents appear relatively minor. Interestingly, the proportion of dart deployments fell in relation to touch stun use over the three-year period. By the end of the third year, tasers had been deployed in dart projectile mode in 53% of incidents (compared to 56% in 2002 and 60% in 2001) and in touch stun mode in 34% of cases.

According to the above data, in 14% of cases tasers were deployed against subjects aged 20 or younger, and included at least one minor. This was a case in which an intoxicated male was observed near the fraternity houses of a university district, stumbling and walking into a lamp post. The report's summary of the case states: "when contacted, the subject refused to stop or cooperate, became extremely belligerent and verbally abusive, and then attempted to flee. After several commands to stop, the officer deployed a taser, which gained the subject's compliance".⁵³

The SPD provided a racial break-down of individuals subjected to tasers through to May 2004, which showed that 45% of subjects were African American and 42% Caucasian.

In a report published in April 2004, the Office of Professional Accountability Review Board: OPARB, the police complaints oversight body for the SPD, recommended that "SPD Taser policy be refined to provide more detailed guidance and training delimiting officer discretion in light of growing Taser experience". The recommendation followed a critical review in the OPARB's annual report of two complaints involving police taser use. In one complaint, a young African-American male (described as "a domestic violence assault suspect") alleged that he was tasered 14 times – a claim disputed by the officer who said he had tasered the suspect "only" four times. The OPARB questioned the police finding that the complaint was "unfounded", noting that, despite the disparity in testimony, the complainant was "undisputably tasered multiple times", an issue which it said raised questions about appropriate use. The other complaint included a claim that a suspect was tasered simultaneously by two officers in touch stun mode while lying handcuffed on the ground. The OPARB criticized the decision of the police department's Office of Professional Accountability to exonerate the officers without determining clearly how many times the complainant (who had photographic evidence of burn marks) had been tasered.⁵⁴ The SPD said it would review the OPARB recommendation and their policy and training.

In September 2004, a 17-year-old teenager zapped with a taser four times on the back of the neck during a traffic stop received \$25,000 in damages in settlement of a claim that Seattle police used had used excessive force and improper procedures. The incident happened in July 2003, when the youth, then aged 16, was riding in a car which was pulled over for a

⁵³ *SPD Special Report: The M26 Taser, Two Years' Experience*, March 2003

⁵⁴ According to the OPARB report, while one officer stated he had used his taser four times on the complainant, the data retrieval device on the other officer's taser had been inadvertently "corrupted" and it was unclear how many times he had pulled the trigger (*OPARB 2003 Year End Report*, April 30, 2004).

faulty headlight. The police report said he appeared to make furtive movements in the back seat. He was tasered when police searched him outside the car and, according to officers, he struggled and resisted. His attorney has reported that scars were still visible on the back of his neck one year later. In agreeing to an out-of-court settlement, the City of Seattle did not admit wrongdoing on the part of the police, but ordered the officer who had used the taser to receive additional training.⁵⁵

Kansas City, Missouri

In June 2004, a Kansas City police officer electro-shocked an unarmed 66-year-old African American woman in her home, as she resisted being issued with a ticket for honking her car horn at police. The incident started when Louise Jones honked her horn while parking behind a police car. The police officers, who were responding to an unrelated disturbance in the street, returned to Ms Jones' house and tried to issue her with a ticket for unlawful use of her horn. She protested and a tussle ensued, during which an officer shocked her twice with his taser.

Kansas City Police Department's policy, introduced in April 2004, allowed officers to use tasers on subjects who displayed "passive resistance": people who refuse to follow police instructions but do not physically resist an officer. Following publicity about the Louise Jones case, the department set up a task force to review its taser policy. It also raised the threshold for when police could deploy tasers, allowing their use only against those engaging in some form of "active resistance". Two officers involved in the Louise Jones incident were later reported to have been disciplined in the case, although the type of disciplinary action was not made public.

The Task Force issued preliminary recommendations to the Kansas City Police Department in September 2004, stating that officers could keep tasers but the department should continually evaluate their use and conduct an independent study into their safety.

Cases reflect wider pattern

Amnesty International considers that using powerful electro-shock technology against unruly children; disturbed, intoxicated but non-dangerous individuals; and people who are non-compliant but who do not pose a probable threat of serious injury to themselves or others, is an excessive use of force which may also constitute torture or other cruel, inhuman or degrading treatment.

There are no national standards on police use of tasers and practice varies between departments, and even (as shown above) within states. However, it appears that many of the situations described above are not confined to a few departments but reflect a wider pattern across the USA. Reports suggest that tasers are commonly used to secure compliance in routine arrest and non-life-threatening situations.

⁵⁵ Information from the *Seattle Times*, 21 September 2004

A statistical analysis of 2,050 taser field applications across the USA, produced for Taser International in November 2002, for example, showed that in 79.6% of cases the suspects were unarmed; of the other cases, 15.6% had an "edged weapon" and 4.8% a firearm; in 4.9% of cases the "suspect weapon" category was "blunt force". An analysis of the "suspect force level" in which a taser was deployed gave the most common category (37% of cases) as "verbal non-compliance". This was followed by "active aggression" in 32.6% of cases; "defensive resistance" in 27.7% of cases and "deadly assault" in only 2.7% of cases.⁵⁶

The survey also provided a "call-out" analysis (the type of incident to which police had responded) which listed 29.8% of cases as "violent" and 27.5% as "resisting arrest". The other categories were "suicide" 14.7%; "civil disturbance" 11.9%; "Barricade" 5.8%; "serve warrant" 5.6% and "officer assault" 4.7%.⁵⁷

1.5 Children

Several of the cases described above involve use of electro-shock weapons against unarmed children, including use of a taser against a child in school and another in a public library. Amnesty International considers that the use of electro-shock weapons against recalcitrant or disturbed children is an inherently excessive and cruel use of force, contrary to international standards recognizing that children are entitled to special care and protection.⁵⁸

While no national statistics are available, such cases may not be isolated. Amnesty International has received reports of tasers being used by police in schools to break up fights or when dealing with other incidents. In some cases, police reportedly fired their tasers when juveniles walked or ran away from officers. A review of cases published by a California newspaper found that few police agencies in Northern California had any minimum age restrictions on use of tasers, a situation that may be similar in other jurisdictions.⁵⁹

According to the field study statistics cited above, 7.69% or 148 of the 2050 taser applications involved people aged from 12 to 18, although no breakdown was given of

⁵⁶ *Advanced Taser M26 Field Report Analysis*, Taser International, November 2002. Amnesty International has also received a copy of a later analysis prepared for Taser International of 2,690 taser field uses, dated May 2003, in which 83% of cases the suspect was unarmed, with the remaining percentages broadly similar to the figures given in the November 2002 report.

⁵⁷ Amnesty International recognizes that this breakdown may not provide a complete picture of which incidents involved some form of violent or threatening behaviour, as these were the initial call-out categories.

⁵⁸ Such standards include the *UN Convention on the Rights of the Child*, signed but not ratified by the USA. As a signatory to the treaty, the US is bound not to do anything to undermine the object and purpose of the treaty. The treaty further enshrines the right of those under 18 to protection "from all forms of physical or mental violence, injury or abuse ...". A child is defined under international standards as a person under 18.

⁵⁹ Concerns arise over dangers youths face being zapped by San Jose police; "Chief defends officers' practices", *Mercury News*, 16 September 2004

children under 18. A later analysis of 2,690 taser field uses shows 183 applications (7.4%) involving children aged 10 to 18.⁶⁰ Taser International has informed Amnesty International that it has records of four children under ten who were subjected to police tasers: one seven-year-old, one eight-year-old and two nine-year-olds, two of whom it says were armed with knives and one with a machete. However, there may be other cases.⁶¹

Most of the children whose cases are described above were involved in relatively minor incidents for which other measures could have been taken to de-escalate the situation. While one child (the schoolgirl tasered in Putnam County, Florida) had a reported history of disturbed or assaultive behaviour, children suffering from mental health or behavioural problems are more appropriately dealt with by health professionals trained in control, restraint and other techniques to deal with potentially violent situations. Rather than helping to control a child's behaviour, the infliction of electro-shocks is liable to increase mental stress and suffering as well as causing physical pain.

Disturbing cases continue to be reported. In May 2004 a police officer from South Tucson, Arizona, used a taser on a nine-year-old girl who was a runaway from a residential home for severely emotionally disturbed children. According to reports, the child was already handcuffed with her hands behind her back and sitting in the back of a police car when the taser was used as an officer struggled to put her into nylon leg-restraints. The officer is reported as saying that the girl was "screaming, kicking and flailing, and would not listen". Reportedly, the officer had requested the taser because he was aware of the girl's combative behaviour from past incidents. Fred Chaffee, president and chief executive of the children's home, was quoted as saying that a lot of children from the home "no matter what they're diagnosed with, have poor self esteem, poor impulse control and poor judgment, a learnt set of behaviours that aren't terribly socially acceptable".⁶² The officer in the case was cleared of criminal wrongdoing but faced an administrative review at the time of writing.

There are also several reported cases in the USA in which parents have disciplined their children with legally available stun guns: such incidents have been characterised as child abuse and sanctions taken against the parents. For example, in May 2003, in Texas, Theodore Moody was sentenced to two years' imprisonment on conviction of injuring and endangering a child, for having repeatedly jolted his eight-year-old stepson with a stun gun to hurry him along to school. Reminiscent of arguments used for adopting stun weapons in law enforcement, both parents reportedly told officers that they did not consider stun gun jolts

⁶⁰ Analysis produced for Taser International, dated May 2003, cited at note 47, above.

⁶¹ As noted earlier, Taser International has estimated that it receives only about a tenth of all reports of taser use from police. An article in the *Arizona Daily Star* on 26 May 2004 reported that ten children under 10, nine aged from one to six years, had been hit by tasers, some inadvertently. The information was reportedly based on a print-out received from Taser International. Taser International told Amnesty International that the statistics cited were inaccurate and that the data had been misinterpreted (five uses, it said, were of animals). Amnesty International has not seen the print-out in question and at the time of writing was seeking further clarification from Taser International.

⁶² *Associated Press*, 1 June 2004

harsh punishment, noting that they left fewer injuries than other forms of discipline such as the “strap”.⁶³ In June 2003, a woman was arrested in Florida for placing a stun gun near to the ear of her 13-year-old daughter to frighten her for disobeying an order not to use a computer.⁶⁴ While US law enforcement policies specifically prohibit using instruments of restraint as punishment, the distinction can become blurred when stun weapons are used as a “compliance” or “control” tool.

1.6 Tasers used against people already restrained or in custody.

While dart-firing tasers are promoted primarily as incapacitating, “stand-off,” weapons which can stop an attacker from a distance, there are reports of people being stunned or threatened with repeated cycles of electro-shocks while already restrained and under police control. Amnesty International considers that using 50,000 volts of electro-shock against people who are restrained and pose no serious threat, is an excessive use of force, amounting in some cases to torture or cruel, inhuman or degrading treatment. The capacity to inflict repeated and extended shocks⁶⁵ at the push of a trigger makes the taser open to abuse in both dart and stun gun mode.

In some cases, individuals have been shot with taser darts, then threatened or stunned with repeated jolts of electricity while the darts remain in place during transportation or custody. For example:

- A handcuffed man tasered during his arrest, who still had the barbs attached, was stunned three more times by police officers for not cooperating when being walked to a police car to be taken to hospital, and for yelling and lifting his foot in the police car. While he was on a gurney (stretcher) in the hospital, an officer shocked him two more times “until he settled down”. (Pueblo Police Department, Colorado)⁶⁶
- An intoxicated man, arrested at a residence after complaints of loud noise, refused to allow police to attend to a cut on his eye and was taken out of the house in handcuffs and leg restraints. He was placed on a gurney to be taken to hospital. When he resisted having his hands tied to the gurney, an officer shot him in the chest with a taser. After going limp, the man again began to “thrash about” on the gurney and the officer “pulled the trigger for another five seconds”. After the man became compliant and was placed in the ambulance, the officer handed his taser to one of the

⁶³ *Houston Chronicle* 26 September 2002

⁶⁴ *St Petersburg Times*, 11 June 2003

⁶⁵ As described above (1.2), the electrical charge can continue beyond the default five seconds, for as long as the officer’s finger remains depressed on the trigger.

⁶⁶ According to a report in the *Denver Post* on 20 September 2004, a third of the 112 people tasered by Pueblo police since January 2003 were handcuffed.

transporting officers "in case she needed to use it again". When the officer went to retrieve the taser later, the transporting officer told him that "she had to use the Taser for one five-second cycle while on the way to hospital because J again became resistive". The suspect was in full restraints at the time.⁶⁷ (Lakeland Police Department, Colorado)

In some US jurisdictions, high security prisoners are made to wear electro-shock stun belts during transportation, hospital visits or court hearings. Amnesty International has condemned such devices as inherently cruel and degrading because the wearer is under constant fear of being subjected to an electro-shock at the push of a remote control button by officers for the whole time the belt is worn.⁶⁸ A similar concern arises in cases such as those described above, where individuals in custody are under threat of repeated cycles of electro-shock at the pull of a trigger for as long as the barbs remain attached.

1. 6 (i) Tasers used as stun guns

While tasers appear to be used most often as dart-firing weapons, in a significant proportion of cases they are used close-up as stun guns. The statistical analysis of taser use, cited above, showed that just over 18% of taser applications were in stun mode.⁶⁹ Some departments have reported a higher percentage. For example, in Seattle, from January through December 2002, tasers were used as stun guns in 32% of cases, and both darts and stun guns were used in 12% of cases; stun gun use rose to 34% of cases in 2003.⁷⁰ In Oklahoma City, in 2003, nearly a third of all taser strikes against suspects were in touch stun mode.⁷¹ In Portland, Oregon, 43% of taser use was reportedly in touch stun mode.⁷²

A Taser International training manual states that the M26 can function in stun mode after the probes have been fired, as a back-up weapon. The training manual also states that, if used only in touch stun mode, the taser becomes a "pain compliance" tool and officers are instructed to apply it "aggressively" to sensitive areas, including the neck and groin.⁷³ Company representatives have told Amnesty International that the primary intent of the stun gun mode is to act as a back-up to the dart-firing function, in case the darts fail to hit their target or become dislodged when the target remains a threat and there is no back-up team or time to reload the cartridge. This is reportedly the only way in which they are permitted to be deployed in the UK. However, it appears that some US agencies frequently deploy tasers in stun gun mode, without using them primarily as a back-up to dart failure in stand-off situations.

⁶⁷ Police incident report

⁶⁸ See *United States of America: Cruelty in Control? The stun belt and other electro-shock equipment in law enforcement* (AI Index: AMR 51/054/1999)

⁶⁹ *Advanced Taser M26 Field Report Analysis*, op cit.

⁷⁰ *Seattle Police Department Taser Use 2001-2003, Key Findings*, May 2004

⁷¹ *The Oklahoman*, 6 July 2004

⁷² *Willamette Weekly*, op. cit.

⁷³ Taser International Certified Lesson Plan, op cit.

Tasers in stun gun mode are particularly easy to use because there is no need to load or reload a cartridge. Their use may be less easy to monitor than the dart-firing function, especially if, as has been reported, the in-built memory chip fails or is not regularly downloaded (see safeguards).⁷⁴ As they are applied through touch stunning the subject's skin or clothing, they tend to be used against individuals who are already in custody or under police control in some way. Amnesty International believes that these factors, together with the capacity to inflict severe pain to sensitive areas of the body, make the stun gun particularly open to abuse. Tasers in stun gun mode have been used to shock or threaten individuals restrained in police cars, hospitals and in local jails. In some instances they appear to have been used to punish prisoners for non-compliance or for simply yelling or "mouthing off" at officers.

Amnesty International is disturbed to note that some departments consider stun guns to constitute a low level of force, on a par with other "pain compliance" techniques such as wrist locks and control holds. There are reports of stun guns being used for minor resistant behaviour, such as prodding someone into a police car, or for getting individuals to comply more quickly while being booked into jail.

The Colorado ACLU has reported on several cases in which individuals were touch stunned while already restrained. Some of the details are confirmed in police reports seen by Amnesty International.

- a man was shocked in the genitals for continuing to resist while he was handcuffed and sitting in the back of a police car. The officer admitted to applying a "drive stun to the groin". (Westminster Police Department, Colorado)
- Police responded to a report of a possible overdose and took an apparently intoxicated and possibly suicidal man to hospital. A police officer applied a taser to the man while he was restrained on a hospital bed, screaming for his wife. According to the police report, "Officer Furney repeatedly told Andre to be quiet and when he did not comply placed the Taser against Andre's chest and tased him once". (Pueblo Police Department)
- A prisoner was strapped into a restraint chair for three hours for yelling and mouthing off. According to the ACLU "Officers periodically approached the prisoner, held a stun gun to his chest, and threatened to shock him. The prisoner has an enlarged heart and may be particularly vulnerable to adverse effects from electroshock weapons".⁷⁵ (Broomfield Detention Center, Colorado)

Similar cases have been reported elsewhere. In Baytown, Texas, a man who had reportedly suffered from two epileptic seizures was touch stunned in an ambulance when, confused and disoriented, he resisted while being strapped onto a stretcher (see 1.7, below). In Minneapolis, Minnesota, an unresponsive, ill man, who was handcuffed behind

⁷⁴ The cartridge also releases confetti-like identification tags when fired (see Safeguards below).

⁷⁵ Letter from Mark Silverstein, Legal Director, ACLU of Colorado, to Denver Mayor's Task Force on police, 15 March 2004.

his back, was touch stunned twice in the back as police tried to lift him into the back of a police car. The man never regained consciousness and subsequently died (see case of Walter C Burks, under 2.6. below).

Some people have been hit with taser darts and then jolted with stun guns while being taken under arrest, as illustrated by the case of Mark Dontae, who was struck ten times with a stun gun as he lay on the ground being handcuffed by police officers (see Oregon cases, above). Most of the 25 people shocked by Portland police while in handcuffs had the taser applied in "touch stun mode".⁷⁶

1. 6 (ii) Jails and custody facilities

Although there are no national statistics on the number of custody facilities which currently deploy stun weapons, according to Taser International at least 1,000 US jails and prisons have adopted the new generation M26 or X26 Tasers, where they are deployed in both dart projectile and stun mode. They join an array of other electro-shock devices, including stun belts, stun shields and stun guns, used for some years in various US custody facilities. While in some facilities stun weapons are deployed only in response to specific incidents (such as disturbances, or movement of high-risk prisoners) in others they are more widely deployed. Amnesty International is concerned by reports that tasers have been used to gain compliance in the case of emotionally disturbed, intoxicated or uncooperative individuals in the booking section of jails. One inmate was reportedly shocked for clenching his fist instead of opening the palm to be fingerprinted; another for refusing to provide a blood sample. Other cases include

- An inmate of Creek County Jail, Colorado, was tasered with escalating jolts of electricity when he refused to pick up a food tray he had thrown onto his cell floor. The inmate was not combative in any way and the taser appears to have been used to punish him for repeatedly ignoring an order. According to the jail incident report, after throwing his food tray onto the floor, he was asked to step out of his cell and told "he would be tazed (sic) if he would not comply". He came out of the cell, as instructed, and sat on a bench. When he ignored orders to go back into the cell to pick up his food tray, he was shot with a taser and subjected to three separate two-to-three second cycles of electricity before a "full five second burst" was applied.
- James Borden, a mentally disturbed man arrested for a parole violation, died in November 2003 after being shocked at least six times with an M26 Taser for being "uncooperative" while he was being booked into Monroe County Jail, Indiana. He was reportedly face-down on the floor with his hands cuffed behind his back when a custody officer applied the shocks. A statement released by the county Sheriff's office after the incident said "standard procedures by trained officers to control combative or uncooperative individuals" had been used. However, a jail officer was

⁷⁶ *Willamette Week* report, op cit

later charged with battery in the case, after a judge found that Borden, while uncooperative, had not engaged in threatening or violent behaviour. (see Section 2 for further details of the case).

- During 2003, nearly a dozen inmates of Greene County Jail, Missouri, were allegedly threatened or abused with tasers for failing to comply with orders. They include a woman allegedly tasered for failing to remove an eyebrow ring while being booked into the jail; and a distraught woman tasered when she failed to quieten down. (See lawsuits, below). More recent allegations from the jail include disturbed inmates being shocked with tasers while strapped down on restraining beds.

Reports of abusive use of electro-shock weapons in US jails and correctional facilities are not new. Amnesty International and others have in the past reported on cases of prisoners being tortured or ill-treated with stun guns, stun shields and stun belts.⁷⁷ In some cases abuses have been linked to guards routinely carrying such devices.

For example, in 1994 in Maricopa County, Arizona, most jail custody staff were equipped with Nova 500 stun guns as part of a pilot study to evaluate the effectiveness of non-lethal weapons. A federal Justice Department investigation subsequently found a serious problem of excessive force in the Maricopa County jails, including misuse of stun guns, which they attributed, in part, to the “easy availability of these weapons.”⁷⁸ The Justice Department’s report noted with concern that stun guns were used to gain compliance from passively resisting inmates or against prisoners who were already restrained. Amnesty International also reported on similar complaints.⁷⁹ The Justice Department’s expert consultant found that part of the problem was due to a change in jail policy to permit stun guns to be used against inmates engaging in “passive resistance” as a “preferred alternative to hands-on force”. He believed this policy, which was in place for two years until changed in 1997, to be “the primary contributor to Detention Staff using these ‘tools’ in ways and under conditions that could well be, and have been, defined as ‘excessive force’.”⁸⁰ In order to avoid a federal lawsuit, the Maricopa County Sheriff’s Office agreed to implement a more restrictive use of force policy which stated that “neither passive nor active resistance” alone

⁷⁷ See, for example, Amnesty International reports *USA: Cruelty in Control? The Stun Belt and other Electro-shock equipment in Law Enforcement* (AI Index AMR 51/54/99); *USA: Cruel and inhuman treatment in Virginia supermaximum security prisons* (AMR 51/065/2001); *USA: A briefing for the UN Committee against Torture* (AMR 51/56/00); *Combating Torture: a manual for action* (Amnesty International Publications 2003, pp 35-36).

⁷⁸ US Department of Justice, Civil Rights Division, letter to Maricopa County Board of Supervisors, 25 March 1996.

⁷⁹ See Amnesty International Report *USA: Ill-treatment of inmates in Maricopa County Jails, Arizona* (AMR 51/51/97).

⁸⁰ Report of Corrections Consultant on the Use of Force in the Maricopa County Jails, Phoenix, Arizona, prepared by George E Sullivan, Salem, Oregon May 14, 1997.

were sufficient to justify use of non-lethal weapons such as Electronic Restraint Devices (stun guns) and prohibited their use "solely to gain compliance".⁸¹

In Virginia, routine deployment by guards of stun weapons in Wallens Ridge and Red Onion supermaximum security prisons led to widespread allegations of prisoner abuse between 1999 and 2001, including use of stun guns on inmates as punishment for minor acts of non-compliance. Several lawsuits were filed against the department for excessive force and in May 2001 the Ultron 11 stun gun was suspended for use in Virginia prisons, following an autopsy report questioning the device's role in the death of a prisoner.⁸²

Amnesty International is concerned that, despite the experience in Virginia and the Justice Department's findings in Maricopa County, use of electro-shock weapons as a routine force tool appears to be on the increase as thousands of officers – in jails and on the streets – are issued with new, advanced tasers. The organization believes that this may similarly increase the potential for abuse of such weapons.

1. 7. Lawsuits for excessive force or ill-treatment

Tasers have been promoted as reducing liability against police departments for excessive force, on the grounds that they are less likely to cause injury than other more dangerous or lethal weapons. However, Amnesty International is aware of a number of lawsuits in which individuals claim to have sustained serious injury or trauma as a result of being tasered, in some cases in grossly inappropriate circumstances. In several cases, the officers' actions appear to have resulted from a lack of clear guidelines or training on the risks involved in using tasers in certain situations. In other cases, the alleged actions appear to amount to deliberate ill-treatment. Substantial damages have been awarded in several cases. Cases include the following:

Arizona: tasered man falls from tree

An \$8m claim was filed against the City of Mesa Police Department, Arizona, in the case of Bruce Bellemore, after he was allegedly left paralyzed in February 2004 when a police officer fired a taser at him as he stood in a tree. The shocks from the taser caused him to fall out of the tree onto his head. Bruce Bellemore was an unarmed suspect who had run from a house into a neighbouring garden, where he climbed the tree in order to escape from four guard dogs. At the time he was shot, he was already surrounded by four police officers, one of whom was pointing a gun at him, with the other three pointing tasers. Bruce Bellemore claims he told officers he was having difficulty climbing from the tree due to an injured wrist. Despite this, it is alleged, the fourth officer shot him once with a taser some 20 seconds after arriving on the scene and fired a second taser shot some 15-20 seconds later while Bellemore was

⁸¹ United States of America v County of Maricopa et al, US District Court for the District of Arizona, Proposed Order 18 November 1997.

⁸² Autopsy report in case of Lawrence Frazier, see below, under 2.7.

convulsing from the first shot. The whole incident, from the time of the arrival of the first officer on the scene, to the time police called paramedics after Bellemore was on the ground, reportedly lasted no more than three and a half minutes. In a letter to the city authorities, Amnesty International said that use of the taser in the case appeared to constitute a grossly excessive use of force, amounting to cruel, inhuman or degrading treatment. Amnesty International also expressed concern at the speed at which the officer resorted to the taser, contrary to standards which require that force be used only as a last resort after non-violent measures have been exhausted, and in a manner designed to minimize damage and injury.

Bellemore's lawyer told Amnesty International that he was concerned that there appeared to be no specific warnings or guidelines in police training manuals he had seen about the inherent risks involved in firing tasers at someone in a dangerously elevated position. An investigation into the incident by the Maricopa County Attorney's office concluded in July 2004 that the officer involved "did not commit any acts that warrant criminal prosecution". The incident was reportedly under police administrative review at the time of writing.⁸³

California: pregnant woman loses baby.

The City of Chula Vista, California, recently paid \$675,000 to settle a damages claim in the case of Cindy Grippi, a woman, six-months' pregnant, who lost the baby she was carrying after she was shot with a taser. The incident occurred in December 2001 when Cindy Grippi reportedly went to enter her house against instructions of police officers during a domestic dispute involving her violent husband. According to her lawyer, she was not engaged in criminal or disruptive behaviour of any kind and no-one was fighting or arguing when police arrived. A police officer reportedly shot her in the back with a Taser as she was walking away from him, some ten seconds after he had got out of his car. She fell belly-down onto the concrete driveway and says she felt a sharp pain in her abdomen as the taser struck her. She was taken to hospital, where a check-up reportedly registered foetal heartbeats and she was discharged. However, some 12 hours later, she was diagnosed with a foetal demise. She underwent delivery of a stillborn child two days later.

According to the initial autopsy report, the 26-week-old female foetus was of normal gestational weight with no evidence of natural disease or trauma. The Medical Examiner could not find a cause of death, but suggested it might be linked with the mother's methamphetamine use. Two experts consulted by Cindy Grippi's attorney reached a different opinion, both finding the most likely cause of the foetal demise to be the electro-shock. One, a perinatalist, suggested that the foetal movement detected, after some difficulty, in the Emergency Room may in fact have been the mother's heart-beat.⁸⁴ Cindy Grippi had reportedly experienced a normal pregnancy, with regular check-ups and foetal movement up

⁸³ The City of Mesa authorities informed Amnesty International that, following the decision not to prosecute the officer, the case would be reviewed by a Mesa Police Department Board of Inquiry to review the incident for possible violations of its policies and procedures.

⁸⁴ Information provided through conversations with Cindy Grippi's lawyer. Amnesty International was unable to obtain the transcripts of the expert testimony.

until the time she was tasered. The mother reported that there was no foetal activity beginning from the time of the taser incident. Furthermore, she had reportedly not taken any drugs during the seven days prior to being exposed to the taser.

The Medical Examiner's report was reviewed by an independent pathologist for Amnesty International, who noted that foetal movement some two hours after the taser incident would appear to suggest no clear link with the taser. However, she also raised a question as to whether the foetal heart tones really had been detected by the Emergency Room, and wondered whether Grippi had been thoroughly examined, given her claim of lack of foetal movement.⁸⁵

Training manuals on taser use state that they are not advised for pregnant women, mainly because of the risk of trauma to the foetus from the mother falling. Otherwise, the company claims that there is no evidence that the electro-shock from a taser could damage an unborn child. However, Amnesty International is concerned by the absence of thorough, independent research into the medical effects of tasers and other electro-shock weapons on pregnant women. One past study has suggested an association between electrical injury from a taser and miscarriage during pregnancy (see 2.7. below).

The officers in Gindy Grippi's case reportedly claimed that they were unaware that she was pregnant at the time the taser was deployed, although Cindy Grippi's relatives have stated that they shouted out that she was pregnant. If the officers' claims are true, this demonstrates a risk of tasers being deployed unwittingly against vulnerable subjects – a risk that could increase if tasers continue to be used as a routine force tool.

Illinois: Pregnant woman sues police

In September 2004, a lawsuit was filed against police from Evergreen Park Police Department, Illinois, by Clarence Phelps and his pregnant daughter, Romona Madison, alleging that they were tasered and subjected to excessive force outside their home. The incident took place on 18 September 2004 at the daughter's wedding reception, when police arrived in response to a complaint about loud music and people dancing in the driveway. According to police accounts reported in the media, Phelps was uncooperative, refusing to produce identification, and was stunned with the taser after he allegedly pushed two officers. The police claimed Madison struck and shoved several officers and ran into the house. She was discovered hiding in a clothes cupboard and, after being warned, was shot twice in the abdomen with a taser when she refused to come out. Lawyers for the family claim that neither Phelps nor Madison had fought with officers and that Madison was followed into the house by overzealous officers who tasered her despite being told by several guests that she was two months pregnant. Madison was taken to a police station and released the same night, after being charged in connection with the incident. She received no medical attention while in police custody, apart from having taser darts removed by paramedics. She went to a hospital

⁸⁵ Report to Amnesty International by Sidsel Rogde MD, PhD, Professor of Forensic Medicine, University of Oslo, Norway.

immediately on her release and, according to her lawyer, was told her baby's vital signs were weak. Her situation was still being monitored at the time of writing.

Portland, Oregon: elderly, blind woman paid damages

In April 2003, the City of Portland, Oregon, agreed to pay \$145,000 to 71-year-old Eunice Crowder in an out-of-court settlement of an excessive force claim. The claim arose from an incident in June 2003 in which City employees arrived at her home with a warrant to remove rubbish and debris from her yard. Police were called when Ms Crowder, who was blind and hard of hearing, failed to follow orders not to enter a trailer where items from her premises were being placed. The lawsuit claimed that two officers struck Ms Crowder in the head with a taser, dislodging her prosthetic right eye from its socket. It also claimed that she was tasered in the back and on the breast as she lay on the ground.

In legal briefs filed by the City, police reportedly acknowledged that Ms Crowder was "pushed onto the dirt next to the sidewalk" when she ignored their orders not to enter the trailer. The police also reportedly admitted that Ms Crowder's eye became dislodged; that they pepper-sprayed her (when she reportedly refused to stop kicking them) and stunned her three times with a Taser (twice in the lower back and once in the upper back). The City argued that the officers' actions were "lawful, justified and privileged" and that they used a "reasonable amount of force to defend themselves".⁸⁶ Nevertheless, City commissioners voted to approve the settlement rather than defend the case in court. The case is believed to have been one factor in a decision by the Portland Police Department to review its policies and impose restrictions on use of the Taser in the case of vulnerable people such as the elderly, children and pregnant women (see above).

Texas: disabled woman one of several to sue Baytown police

Several lawsuits have been filed against officers from the Baytown Police Department, Texas, for alleged abusive use of Tasers. Naomi Autin, a 59-year-old disabled Latina woman, was reportedly tasered three times by police officer Micah Aldred in July 2003 for banging on her brother's door with a brick. According to a lawsuit filed by Autin, she had gone to her brother's house to collect mail while he was away, and became worried after failing to get an answer from the house-sitter and seeing a truck parked in the driveway. She called the police and officer Aldred arrived on the scene. Autin, who is 5 feet 2 inches tall and suffers from severe arthritis, was allegedly tasered in the back by Aldred after she continued to try to gain entry to the house; the officer also allegedly threw her against a post, causing a severe cut to her head. A grand jury indicted the officer on charges of using excessive force, but he was acquitted at trial. Reportedly, police officers corroborated his account that the use of force was justified. Amnesty International understands that no disciplinary action has been taken against the officer.

⁸⁶ City Pays Excessive Force Claim, *OregonLive.com* 23 April 2004

The same officer is a defendant in another lawsuit in which an unarmed woman wanted on an outstanding arrest warrant was allegedly "shocked numerous times about the back, face, neck, shoulders and groin".⁸⁷

A lawsuit is pending against another Baytown officer for alleged excessive force during an incident in July 2003, in which the officer used a taser as a stun gun on a man who had just suffered epileptic seizures. The officer reportedly stunned 30-year-old Robert Stanley Jr at close range in an ambulance as medical personnel struggled to strap him down as he struggled in the throes of post-seizure confusion. An Internal Affairs investigation into the incident found that the officer had not violated any policies, and a grand jury investigation reportedly supported police accounts that Stanley had been sufficiently combative to warrant use of the taser.⁸⁸

Washington: immigrant woman tasered in front of sons

A lawsuit has also been filed in the case of Olga Rybak, a 5 feet 4 inches tall Russian immigrant woman who was tasered multiple times by an officer from the Washougal Police Department, Washington, in August 2003, after she refused to sign a citation for a dog violation. The officer had gone to her house with the citation after her dog had bitten an officer the previous day. Rybak, who spoke little English, at first refused to sign it, asking for a translator. While attempting to arrest her, the officer shocked her at least 12 times in 91 seconds in front of her two young sons – first using the weapon as a stun gun, then stepping back to insert a cartridge and twice firing darts at Rybak who was writhing around on the front porch. When the boys (aged 11 and 12) tried to help their mother, the officer reportedly threatened to taser them as well. Rybak's attorney has informed Amnesty International that the boys have been receiving psychiatric treatment for Post Traumatic Stress Disorder as a result of the incident.

According to the attorney, the shocks caused extreme pain and left 27 red burn marks on Olga Rybak's body. The officer who used the taser (who was a taser Training Officer for the department) did not record the number of jolts in his report. The taser chip was tested only after photos of Ms Rybak's injuries were presented, and this recorded that the taser had been discharged 12 times during the incident.⁸⁹ In April 2004, Washougal's police chief, Robert D Garwood, reported that the officer had been demoted for using "poor judgement" in the case

⁸⁷ Aldred was also one of five officers involved in the arrest and death of Luis Torres, a migrant worker from Mexico, in January 2002. A medical examiner ruled Torres' death a homicide during a police struggle, caused by compression of his airways. However, Aldred and others were cleared of using excessive force in the case.

⁸⁸ Source: attorney for plaintiff; Houston Chronicle, 27 October 2003

⁸⁹ There remains some discrepancy between the injuries and the taser strikes recorded, unless the probes jumped around as they were fired into her body. However, it is clear from the record that the trigger was pulled (in dart and stun mode) at least 12 times.

even though he had acted “within proper legal boundaries”. Garwood said that the department would review its policy on taser use.⁹⁰

Greene county jail, Missouri

A federal lawsuit was filed in February 2004 against the Sheriff and officers of Greene County Jail, Missouri, alleging a pattern of serious ill-treatment of jail inmates, including abusive use of tasers. The lawsuit was brought on behalf of 11 former inmates, most in temporary custody pending the posting of bail. The allegations of abuse ranged from physical brutality and excessive force to acts of humiliation, including guards forcing female inmates to take off their clothes in the presence of male staff and exposing them to the gaze and ridicule of guards and male prisoners. They include the following accounts from the alleged victims:

- An African American woman was asked to remove her jewellery on being booked into the jail in June 2003. She removed everything except an eyebrow ring, which was difficult to remove. When she asked for a mirror she was allegedly sprayed in the face with pepper spray and, when she put her hands up to protect her face, was shot with a taser, causing her to fall to the ground and lose control of her bladder. While on the ground, a male officer forcibly removed her eyebrow ring with pliers. She was left in her urine for several hours without being given anything to clean herself with.
- A man being taken to the “drunk tank” was slammed to the ground face-first. As he lay on the ground bleeding, a guard allegedly fired a taser gun at him, causing acute pain, although he was not moving or struggling. He was taken to hospital where he had stitches to his mouth. On return to the jail, when told he had failed to shampoo his hair satisfactorily, an officer threatened him with a taser gun, saying “you don’t want this again”. On his release, the jail tried to get him to sign “reprimand papers” stating that he was shocked with a taser because he had attempted to run to the jail entrance; according to the lawsuit, he refused to sign the papers because the facts in it were not true.
- A man who said he might be allergic to soap in the shower was threatened with a taser gun and told to use the soap provided.
- A man booked into the jail on an outstanding traffic warrant was allegedly assaulted and subjected to an “overly invasive bodily search” and repeatedly called a “faggot”.⁹¹ He was allegedly tasered while he was prostrate and in handcuffs.
- A woman booked into the jail in March 2003 was placed in a cell by herself in a distraught condition. A jail employee said he would taser her if she did not be quiet and calm herself. It is alleged that, while she was attempting to calm down, two guards entered her cell and one attached two taser clips to her shirt in the chest region; the other guard then activated the taser gun. According to the lawsuit, she suffered

⁹⁰ Sources: The Vancouver Columbian, 26 April 2004, citing police reports; Oregonian, 9, 23 April 2004.

⁹¹ A term of abuse for gay males

"severe burns and permanent scars to her chest and stomach" as a result of being tasered.

- A woman instructed to strip front of male guards hesitated after removing all her clothes except her underwear; she was pushed into the shower by a male guard and saw an officer pointing a taser at her as she emerged from the shower. It looked like a firearm and she was very scared, begging the officer "don't do this". She was given nothing to dry herself with and she was escorted from the room by male guards while wearing a small paper garment resembling a "diaper" and forced to walk past male inmates waiting to be booked into the jail.

The lawsuit alleges that the complaints formed part of a pattern of abuse and poor training at the jail. According to Amnesty International's information, no charges have been filed against any of the officers involved and they remain on duty at the jail. The lawsuit was still pending at the time of writing.

1. 8. Safeguards and monitoring of taser use

One of Amnesty International's concerns is that electro-shock weapons can easily be used to ill-treat people without leaving substantial visible marks or injury. This can make it difficult for victims of abuse to obtain redress through complaints or lawsuits: one way of holding officers or police departments or authorities accountable. It remains essential - all the more so when deploying techniques that may not leave substantial marks or physical injury - for police and oversight agencies to ensure there are stringent safeguards in place to prevent abuse.

The new generation M26 or X26 type tasers are promoted as having a number of in-built safety features intended to guard against abuse and provide an audit trail to monitor each taser deployment. When darts are fired, confetti-like identification tabs are ejected which are printed with the cartridge's serial number, allowing departments to determine which officer fired the cartridge. Both the M26 and X26 tasers also have an on-board microchip memory function which records the date and time of each firing (trigger pull); this applies whether the taser is used in dart or touch stun mode (although the microchip cannot distinguish which mode the weapon is in). The data can be downloaded onto a computer which, according to the company, downloads to text in the case of the M26 but is encrypted in the case of the X26 to protect the integrity of the data.

The X26 Taser also records the duration and battery strength of each firing. This is important safeguard in monitoring how much force has been applied because, as shown above, the cycle of electricity can be prolonged beyond the five-second automatic discharge and can continue for as long as the operator's finger remains depressed on the trigger (reportedly, until the battery runs out). Officers may also cut off the flow of electricity before the standard five-second burst by switching the safety switch. However, the ability to record the duration of each firing is *not* contained in the M26 Taser, which remains widely used (possibly by a majority of US police agencies).

When asked by Amnesty International if there was a cut-off point for the duration of the cycle, Taser International replied that "there is no automatic cut-off" and "Given that these devices may be used in life-threatening situations, we believe it would be dangerous to build in an automatic weapon failure point", adding that "This is an area where we must rely upon the professional judgment and training of the officer".⁹² However, Amnesty International is concerned that the ability to inflict prolonged electro-shocks increases the weapon's potential for abuse, particularly in the case of the M26.⁹³ The fact that, in practice, tasers are used in a wide range of non life-threatening situations adds to the organization's concern. According to the testimony of a police taser training officer in one department, officers were trained to use the taser "as many times as it takes to gain compliance."⁹⁴

The microchip function provides an important tool of accountability, especially in the case of the X26. However, it is not failsafe. In certain instances a "corruption" may occur during the firing cycle which prevents the software from recording the firing record, and the internal clock may not always be set accurately.⁹⁵ Amnesty International was told that the clock has to be re-set whenever the device is stored without batteries. Most importantly, such safeguards need to be backed-up by monitoring and regular downloading of information, as well as detailed use-of-force reports filed by all officers at the scene. There are a number of concerns about the adequacy of safeguards and monitoring of taser use in practice, including the following

- While most departments require officers to fill out a written use-of-force report whenever they fire their tasers, sources have reported that not all departments automatically download the microchip data to match against the police reports (to check, for example, how many times the charge was triggered). It is also unclear how many departments regularly download the microchip data for general monitoring purposes. The organization believes it is essential that all relevant data on taser use be regularly reviewed and analysed.
- The quality of information provided in police reports varies. It appears that not all departments, for example, explicitly require officers to record when tasers are drawn

⁹² email from Rick Smith, Taser International, 7 October 2004

⁹³ There is no maximum cycle and the duration of the charge could last until the battery is depleted, which Amnesty International has been told could, in theory, be just over four minutes, although no such instance has been recorded.

⁹⁴ Testimony of a Las Vegas Metropolitan Police Department taser training officer at the inquest of William Lomax, 25 June 2004 (see under **Deaths in Custody**, below).

⁹⁵ Amnesty International has seen several cases in which officers' reports on the number of trigger pulls are inconsistent or contradict witness statements. In one case, the record could not be verified as the data on the officer's unit had become "corrupted"; a police review board quotes an instructor as stating that such data corruption is "not unusual" due to inability to insulate the data retrieval instrument from the high voltage components of the device (Seattle Office of Professional Accountability Review Board Annual Report 2003). This is listed as a potential occurrence in Taser International's website which states that "there is no correction available for this problem" but that "new data will be recorded normally". In another case, the various clocks involved failed to record the time sequences accurately due to inaccurate settings (see ref to Glenn Leyba death in custody case, Glendale, Colorado, below).

and displayed, when not fired. According to Taser International's website, it is quite common for officers to "spark" their tasers or direct the laser beam at someone to secure compliance without actually firing the weapon. As this is a significant threat of force, such incidents should be recorded on the use-of-force form so that the appropriateness of the force level can be reviewed. All police officers should also be required to record every trigger pull; this has not always happened, according to reports Amnesty International has seen.

- Because often they do not leave substantial marks or injuries, police taser use may not be subjected to the same levels of scrutiny as weapons such as batons or flashlights which trigger investigations when injuries result. Tasers receive far less scrutiny than police firearms use, where incidents are usually reviewed at a higher level within the department (such as a Firearms Review Board) as well as by outside review bodies.
- There is little public scrutiny of taser use either nationally or within police departments. Police use-of-force reports are generally not made public and most police departments have not released detailed public reports about their taser use to date. Amnesty International believes it is essential for police departments and authorities to provide detailed, public reporting on use of electro-shock weapons given their capacity for misuse. Public concern about reports of inappropriate use have led some departments to review their policies (see Portland, Oregon, for example).
- There are no national standards and no official statutory, national, reporting system on taser use, or any independent mechanism for collecting and evaluating field data. While Taser International maintains its own database of use, the company estimates that only one in ten deployments of Advanced Taser are reported to the company by police forces.⁹⁶

1. 8 (i) Safeguards against unwarranted injuries

While tasers are promoted as causing less injury than other impact weapons, serious injuries can arise if the barbs strike certain parts of the body or the subject is in a vulnerable location. Officers are trained not to fire the dart projectiles at sensitive areas such as the head, throat, eyes or groin, and both the M26 and X26 models have laser trained beams designed to ensure accuracy when the darts are fired.

Secondary injuries can also occur when the subject collapses and falls to the ground. The manufacturer's safety guidelines warn of the risks of death or serious injury if someone is tasered while at risk of falling from a high building, although it is unclear to the organization how far law enforcement policies include a more general warning about the dangers of firing tasers at people in elevated or other vulnerable situations. One man in Arizona, whose case is

⁹⁶ See note 24, above

described above, was paralyzed after being tasered out of a tree.⁹⁷ In June 2004, in Louisiana, Jerry Pickens, aged 55, died after falling and hitting his head on concrete when police shot him with a taser. Pickens, who was drunk and unarmed, was shot in the back as he tried to walk back inside his house following a domestic argument. His family questioned why police had resorted to the taser in his case.

The taser darts can puncture skin and cause burns at the barb sites. These are reported to be minor in most cases. However, several cases have been reported in which scars from taser burns have remained visible many months after the incident. Some US departments require all persons struck by taser darts to be taken to hospital to have the barbs removed but not all agencies have this requirement.

Although maintaining that tasers are “medically safe” (an issue discussed below), Taser International has warned in training literature that it is “not advisable” to use the Advanced Taser on a pregnant woman or an elderly person, unless all other means short of lethal force have been used, because of potential risks in such cases.⁹⁸ However, it is unclear how far such warnings are incorporated into police agencies’ guidelines. As described above, two women were stunned despite alleged warnings by others present that they were pregnant.⁹⁹ Several elderly people have been tasered despite posing no serious threat. At least one agency, the Portland Police Department, Oregon, had no guidelines restricting taser use against pregnant women or the elderly, until the policy was changed earlier this year. It has recently been reported that the warning against using tasers on the elderly is no longer included in Taser International training manuals, as the device is no longer considered harmful in such cases.¹⁰⁰ Amnesty International was seeking clarification of this with the company at the time of writing. Meanwhile, the organization remains concerned about the use of tasers against elderly people, given their enhanced risk of suffering injury from falls as well as an increased risk of underlying health problems.

The company also issues a warning not to use tasers in flammable or combustible environments because of a risk of ignition from the sparking action. However, in Colorado, a police officer reportedly fired a taser at a man parked next to gasoline pumps at a convenience

⁹⁷ See Bruce Bellemore case, under 1.7 above. Bellemore’s attorney told AI there appeared to be no specific warnings of the dangers of firing tasers at people in elevated positions in the department’s policies. The officer was cleared of criminal wrongdoing. The officer’s actions were under police administrative review at the time of writing.

⁹⁸ Certified Lesson Plan, Version 8 (op cit). The company maintains that the electrical output of tasers is not harmful to a fetus, but that secondary injuries from falling are a possible issue for pregnant women. The question of whether electro-shocks from tasers could trigger miscarriage remains a matter of some dispute (see 2.9, below).

⁹⁹ Cases of Cindy Grippi, and Romona Madson (see above, under **Lawsuits**). Amnesty International was unable to obtain information on whether the force used in the Cindy Grippi case was within police policy, as the results of police internal investigations are “privileged information” and not available to the public under California law. Amnesty International was seeking more information on the recent Madson case (Illinois) at the time of writing.

¹⁰⁰ “City’s use of taser similar to others”, *The Charlotte Observer*, 31 October 2004

store, despite this being a high-risk environment.¹⁰¹ In California, a man was touch-stunned while lying on a garage forecourt (see case of Roman Gallius Pierson, at 2.3, below).

In Joplin, Missouri, there was concern that a gas explosion that killed a suicidal man and fatally injured a police officer in August 2004 may have been triggered by police use of a taser. The disturbed man had turned on the gas in his home before police arrived and the house exploded after one of the officers fired his taser at him. The final report of the investigation into the 11 August incident, made public in October 2004, found there was not enough conclusive evidence to determine the cause. Police said that electric light switches, a pilot light, an electric fan or static electricity on the suicidal man's clothes could have ignited the gas.¹⁰²

Company literature includes a warning never to use a taser on someone who has been exposed to alcohol-based pepper sprays, which are highly flammable. Some police agencies are reported to have switched to non-flammable water-based pepper sprays following the introduction of tasers. However, flammable sprays remain on the market, available for both law enforcement and private use. Several people have been pepper sprayed and then struck with tasers (see 2.6, below). In one recent case, a man's hair is reported to have caught fire after he was pepper sprayed and tasered.¹⁰³ Amnesty International was seeking information on the solution contained in the sprays used in this and other cases, at the time of writing.

Amnesty International believes that all tasers should be subjected to safety tests to ensure that they will not cause unwarranted injuries or fatalities because of their design and technological functioning in real-life situations. All agencies which deploy tasers should issue detailed safety guidelines, with clear warnings and restrictions on their use in high-risk situations. Amnesty International also believes it is advisable to take tasered subjects to hospital to have barbs removed and to check for other possible adverse effects.

1.9 Widening taser use

In many of the police taser incidents described in this report, officers appear to have breached international standards requiring that law enforcement officials must apply only the minimum necessary force after exhausting non-violent alternatives. However, in most such cases, the officers' actions were not found to have violated police use-of-force policies. Amnesty International believes that no safeguards can be effective without tighter policies and measures to limit the circumstances under which tasers are authorized.

Some US law enforcement agencies, including the New York City Police Department (NYPD), issue tasers only to specialised units such as emergency response teams. However, many departments, far from limiting taser use, are moving towards routinely arming all their

¹⁰¹ Reported in the *Denver Post*, 20 September 2004.

¹⁰² *Associated Press*, 12 October 2004, "Police baffled by cause of fatal explosion".

¹⁰³ Robert C Trough was "sprayed repeatedly with pepper spray and zapped with a Taser that set his hair on fire" before he was fatally shot after reportedly taking an officer's gun (*Washington Post*, 18 August 2004).

patrol officers with such weapons. As of June 2004, more than 700 US police agencies, including those in Albuquerque, Phoenix, Reno, Sacramento, San Diego, San Jose and the Orange County Sheriff's Office (Florida), are reported to have purchased Taser products for every front line patrol officer, a trend which appears to be increasing.

Data from the Orange County Sheriff's Office in Florida showed that, by May 2002 – just over a year after they were first deployed – tasers had become the most prevalent force option for the department, constituting 68% of all use-of-force incidents (see chart, below). Taser use reportedly rose to 77.6% of all force incidents in 2003.¹⁰⁴

However, the data also reveals that, while police use of chemical sprays, police dogs, physical force and firearms dropped by about 21% in the year after tasers were introduced, the overall number of times force was used by Orange County deputies actually *increased* by 37%.¹⁰⁵ A brochure on Taser International's website reports a staggering 72% increase in use of force by Orange County deputies from 1999 to 2002, in line with increased taser use.¹⁰⁶ Similarly, in May 2004, a local news agency reported that the use of force against suspects in the city of Orlando, Florida, had “nearly doubled in the last 14 months since Tasers were issued to police”, although they arrested fewer suspects.¹⁰⁷ According to the same source, while police injuries in Orlando decreased significantly, injuries to suspects stayed the same.

Use-of-Force Breakdown for the Orange County Sheriff's Office, Florida

	1999	2000	2001	2002*
Chemical Force	300	263	221	64
Physical Force	78	75	52	29
Firearms	5	13	4	0
K9	62	60	48	29
Impact Weapons	27	21	13	5
Impact Rounds	0	1	2	0
TASER	0	3	228	201
Total Use-of-Force incidents	410	383	527	295

¹⁰⁴ *Orlando Sentinel*, 29 April 2004

¹⁰⁵ “Taser Works So Its Use Increases”, *Orlando Sentinel*, 29 July 2002 (based on data obtained from the Orange County Sheriff's Office).

¹⁰⁶ www.taser.com/pdfs/m26brochure.pdf. The brochure states: “Deputy injuries in Orange County, FL dropped by 80% from 1999 to 2002 despite a 72% increase in use of force over the same period – from 410 force incidents in 1999 to an annual rate of 708 incidents in 2002”.

¹⁰⁷ “Police Taser Use Grows, Controversy Continues, Local 6 News (*local6.com*), 4 May 2004

* Data through May 2002 only. Source: Orlando Sentinel, 29 July 2002.¹⁰⁸

The above data suggests that officers may be using tasers in situations which would previously have been resolved without the use of force. Amnesty International is concerned that issuing such weapons to all patrol officers may increase officers' readiness to resort to such force, given the ease with which tasers can be used, and the temptation to use them preemptively at the first sign of resistance. This may lead to an increase in cases of excessive force and ill-treatment, especially given the broad range of circumstances in which tasers may be authorized.

In addition, Amnesty International is concerned about the potential risks of unwarranted injuries and deaths if tasers are used against a widening pool of the population, many of whom may have underlying health conditions which could make them vulnerable to adverse reactions from electro-shock. The potential health risks are discussed in chapter 2 below.

¹⁰⁸ The data lists type of force used. The total is thus higher than the total number of incidents, as more than one type of force was used in some incidents.

2. DEATHS IN CUSTODY AFTER TASER USE

Since June 2001, more than 70 people have died in police custody in the USA and Canada after being struck with tasers, with the number of reported cases rising each year. Amnesty International's data shows two deaths reported in 2001, 13 in 2002, 20 in 2003 and 38 from January to mid-October 2004.¹⁰⁹ These figures are higher than the total number of taser-related deaths reported in the previous 25 years.

The manufacturers of stun weapons claim that their products are medically safe, an issue discussed in more detail below. Taser International, which told Amnesty International that it tracks reports of deaths, has issued a number of public statements asserting that in no case has the taser been found to be a "direct cause" of a fatality. The company has pointed out that the deaths are similar to thousands of other in-custody deaths in the USA from drug induced causes or other factors unrelated to taser use. They claim that the increase in taser-related fatalities is due to the fact that tasers are now more widely deployed and will inevitably be used in some cases where people are in the throes of toxic overdoses or other fatal conditions. In several cases their own medical experts have reviewed the evidence and specifically excluded the taser as a cause of death.

Amnesty International acknowledges that coroners have usually attributed cause of death to factors unrelated to taser use, such as drug intoxication or heart disease. However, some medical experts believe taser shocks may exacerbate a risk of heart failure in cases where people are agitated or under the influence of drugs or have underlying health problems. In at least five recent cases, coroners have found the taser contributed to the deaths (see below). The rising death toll heightens Amnesty International's concern about the safety of such weapons and the lack of rigorous, independent testing of their medical effects. While there have been some limited studies of earlier stun weapons, there has been no peer-reviewed medical literature published on the medical effects of the new more potent M26 or X26 Advanced Tasers deployed in the cases described in this report.

Amnesty International has reviewed information on 74 deaths reported since June 2001, including autopsy reports in 21 cases.¹¹⁰ Nine of the deaths occurred in Canada, with the rest in the USA. The deceased were males aged between 18 and 59 years of age, of

¹⁰⁹ There are no official national figures for the number of deaths in custody involving taser use. The list of cases comes mainly from news reports, backed up where possible by other data.

¹¹⁰ In many of the more recent cases, autopsy reports were not yet available. In some other cases Amnesty International's requests for autopsy reports were denied as state law prevented them from being made publicly available. Other information includes media reports, statements issued by coroners' offices, paramedic reports, lawsuits and information from lawyers acting for the deceased's family. In some cases Amnesty International sought additional information, including copies of police incident reports, from the police agencies involved; however, this latter information was often not made available due to ongoing investigations or pending litigation. In three cases, Amnesty International's sole source was information provided in a list of deaths published by Taser International on 5 April 2004, in response to a CBS Evening News report on stun fatalities broadcast on the same date.

varying racial or ethnic origin, with the exception of one case involving the death of a female foetus after the pregnant mother was tasered.¹¹¹ Most cases are believed to involve use of the M26 Taser which was the version most widely deployed during the period in question. While detailed information was not always available, the cases nevertheless highlight some disturbing concerns which Amnesty International believes should provide the basis for a full, independent inquiry and further research.

2. 1. Overview of AI concerns:

Many of the deaths involved individuals who had apparently high concentrations of drugs in their system or other risk factors for fatal arrhythmias. Drug intoxication, sometimes combined with other factors, was overall the most common cause of death reported (although coroners' reports were still pending in many of the more recent cases). Violent struggle, "positional asphyxia" following restraint, and "excited delirium"¹¹² were cited in some cases as a sole or contributory factor leading to sudden cardiac arrest. However, Amnesty International believes that questions remain about the role of the taser in at least some of the fatalities: whether the electro-shock could have exacerbated breathing difficulties caused by factors such as violent exertion, drug intoxication or use of other restraint devices, triggering or contributing to cardiac arrest. At least 15 of the victims had underlying heart disease which some medical experts believe may cause more susceptibility to electro-shock. Concerns have also been raised about the potential risk of adverse effects from taser currents in people under the influence of certain drugs.¹¹³

These concerns are supported by the fact that, in five cases (James Borden, William Lomax, William Teaseley, Jacob Lair and Keith Tucker), medical examiners found that the taser had directly contributed to the deaths, along with other factors, including heart disease, restraint and/or drug intoxication. In another case (Gordon Randall Jones), a coroner is cited as stating he believed the taser played a role in the death. The short time lapse between taser use and cardiac or respiratory arrest in some cases also raises issues of concern, and in one case (Alvarado) the coroner noted a temporal link between the taser and cardiac arrest and said he was unable to exclude the taser use as a possible cause. In another case (Clever Craig), the coroner also may have indicated a link with the taser given his autopsy finding of cause of death to be: "cardiac dysthythmia during an episode of excited delirium following electrical

¹¹¹ In many cases the deceased's race was not reported.

¹¹² A condition known as "excited delirium", sometimes also referred to as "in-custody death syndrome", has been attributed by some US coroners to a number of deaths in custody, especially in the case of persons on drugs or suffering from psychosis. It is a combination of signs and symptoms, including dangerously elevated body temperature levels, leading to sudden death. The theory relating to such a syndrome is controversial and disputed by some medical experts.

¹¹³ See, for example, reference below (2.7) to the UK Defence Scientific Advisory Council subcommittee on non-lethal weapons' recommendation that further research should be undertaken into cardiac hazards associated with use of the taser on certain at-risk subjects, including "possible hyper-susceptibility to taser currents arising from drugs commonly used illegally in the UK, acidosis and pre-existing disease".

shock". In several cases death was given simply as "sudden cardiac arrest", with no clear underlying causes (see, for example, the case of Frederick Jerome Williams, below and also the case of Richard Baralla, under 2.6). These cases also raise questions as to whether the taser may have been a factor. A chart attached as Appendix A lists the 74 cases, giving (where information was available) cause of death; contributory factors cited in coroners' reports; number of taser discharge cycles; time lapse between taser shock and cardiac or respiratory arrest.

Dr Sidsel Rogde, an independent forensic pathologist who reviewed 16 autopsies for Amnesty International, also raised concern about a possible link between the taser and deaths, giving her opinion that it could not be ruled out as a contributory factor in at least seven cases.¹¹⁴ (It should be noted that the autopsy reports were not available to Amnesty International in three other cases where coroners reportedly found the taser played a role in the deaths – William Lomax, William Teaseley and Jacob Lair – so these cases were not included in Dr Rogde's findings.). Dr Rogde also questioned the findings relating to drug toxicity in some autopsies, noting that high blood concentrations *post mortem* may reflect a redistribution of blood during, for example, resuscitation, and do not necessarily reflect toxic levels of drug concentration before death. There were also several cases in which death was attributed in the autopsy report to drug intoxication where the drug levels were not necessarily fatal. Dr Rogde stated: "In my opinion, death can be attributed to drug overdose only when other causes are excluded". Dr Rogde's comments are included in some of the individual case summaries, below.

Amnesty International is also concerned about the overall levels of police force used in the cases reviewed which, in many instances, appears to have gone beyond what was warranted by the threat posed. In only eleven cases were suspects reported to be armed. While most of the deceased had been engaged in disturbed or agitated behaviour, and some were reportedly combative during arrest, few appeared to pose an immediate threat of substantial physical harm at the time force was used. Yet they were subjected to high levels of force which sometimes involved multiple restraints, including use of chemical spray, taser and dangerous techniques such as "hogtying" (see below). Two people died in Gwinnett County, Georgia, after being tasered and strapped into restraint chairs. In several cases the taser appears to have been deployed against individuals passively resisting arrest or refusing to comply immediately with an order. In one case, for example, a mentally disturbed man was reportedly tasered after refusing to step out of his shorts while being booked into a jail; another man was tasered as he lay supine on the floor of his home in a drug-induced stupor.

¹¹⁴ Report to Amnesty International from Sidsel Rogde MD, PhD, Professor of Forensic Medicine, University of Oslo, June 2004. Cases where Dr Rogde found the taser to be a possible contributory factor were: Eddie Alvarado, Richard Baralla, James Borden, Dennis Hammond, Glenn Leyba, Gordon Randall Jones and Michael Sharp Johnson. In some of the 16 cases reviewed there was insufficient information to assess the possible or likely role of the taser. Dr Rogde also reviewed autopsies in two cases of individuals who died from other stun weapons, cited later in this report (Garcia and Frazier); in those cases she concurred with coroners' findings that the stun weapons played a role in the deaths.

Another man stopped on suspicion of driving while intoxicated was tasered after he had fallen into a ditch and, according to a police spokesperson, "was resisting, but he wasn't fighting".¹¹⁵

Based on the available information, Amnesty International believes that in many cases the police use of force was excessive, contravening international standards and amounting in some cases to cruel, inhuman or degrading treatment. In only one case (Borden) was an officer criminally charged with excessive force; in most cases officers' actions were found not to have contravened either criminal statutes or policies, although a number of cases remained under investigation.

Several lawyers representing families of the deceased expressed concern to Amnesty International at what they believe was undue force in the case of individuals who were ill or mentally disturbed and should have received treatment rather than a response more appropriate, as one lawyer put it, to a "crime in progress". At least a third of those who died had histories of mental illness or showed signs of mental disturbance at the time of their arrest. Others were ill through drug intoxication or other causes (e.g. epilepsy). One person was observed to have seizure activity before he was shocked (see Alvarado case, below). Many of these individuals were not involved in criminal behaviour at the time they were taken into custody. Amnesty International believes that the appropriate response in such cases should have been to seek medical attention or the assistance of services such as a mental health crisis intervention team rather than a law enforcement response. Although paramedics were often called to the scene, in some cases there were delays, or the deceased were taken to jail rather than to hospital.

In some of the above cases officers' actions appear in breach of Article 6 of the UN Code of Conduct for Law Enforcement Officials which states that "Law enforcement officials shall ensure the full protection of the health of persons in their custody and, in particular, shall take immediate action to secure medical attention whenever required." Article 6 (b) states that where medical personnel are attached to a law enforcement operation "... law enforcement officials must take into account the judgement of such personnel when they recommend providing the person in custody with the appropriate treatment through, or in consultation with, medical personnel from outside the law enforcement operation".

2. 2. Multiple or prolonged taser discharges

Amnesty International is further concerned that, in more than half the cases, the deceased were subjected to multiple taser discharges (cycles of electro-shock), in one case as many as 12 or 13 jolts and in some others six or more discharges.¹¹⁶ In most such cases each cycle would normally last for the full default five-seconds (or in some cases, longer, see below). Information on these cases suggests not only that the taser was not immediately effective on

¹¹⁵ *Star-Telegram*, 13 September 2004, reporting on case of Samuel Wakefield.

¹¹⁶ There were reports of multiple taser discharges in 41 of the 73 cases reviewed. However, the true number is likely to be higher as in 28 cases the number of discharges was not reported in the information available.

the first shock but that it may have caused the subject to become more agitated in some instances, leading to further use of force. A training manual on the Advanced M26 Taser produced by Taser International, advises officers to "be prepared to deliver more than one cycle from the Taser, and be prepared to use strikes, impact weapons and other uses of force in conjunction with the Taser to gain compliance".¹¹⁷ The company maintains that it is safe to use repeated cycles as the amperage (current) remains the same and the charge is not multiplied. However, Amnesty International believes that questions remain about the harm and stress caused by subjecting someone already in an agitated state to multiple electroshocks, especially in conjunction with other force.

According to a field study of 2050 taser uses, most incidents involved only one taser discharge.¹¹⁸ It appears that the reported fatalities cases may therefore involve a disproportionate number of multiple discharges (as well as other force), an issue which Amnesty International believes requires urgent review.

The ability to prolong the electrical cycle beyond five seconds, for as long as the officer keeps his finger depressed on the trigger, is also of concern as this may dangerously increase stress levels. In one case, an officer applied repeated jolts of the taser in stun mode to the neck of a disturbed man high on drugs who was being pinned down by four security guards trying to handcuff him. One jolt lasted for eight seconds; another for six seconds. The man subsequently went into cardiac arrest and later died. An inquest jury attributed cause of death, in part, to the taser (see case of William Lomax, below). The psychological and physiological effects of prolonged, as well as repeated, taser shocks also requires urgent review by relevant independent experts, including those in the field of cardiology and electrophysiology.

2.3. Sample case summaries

- James Borden, aged 47, died in Monroe County Jail, Georgia, on 6 November 2003, after being stunned at least six times with an M26 Taser. Police had arrested him earlier that evening for violating a home detention order (Borden had been spotted the previous day acting in a confused and disoriented state near a local convenience store).¹¹⁹ According to a subsequent lawsuit, at the time of his arrest Borden "exhibited slurred speech, was unstable on his feet and was physically weak". An Emergency Medical Team (EMT) ambulance was called and medical personnel indicated that he needed to go to hospital but he was taken to jail instead. He was tasered on arrival at the jail, reportedly for "thrashing around" and talking

¹¹⁷ Certification Lesson Plan, op cit.

¹¹⁸ Advanced Taser M26, Field Report Analysis, November 2002 (Taser International) According to the data, one five-second discharge or less was used in 68% of incidents, with 32% of incidents requiring more than one cycle. In 521 incidents the duration and number of cycles is listed as "unknown", suggesting possible shortcomings in the reporting of data from the agencies involved.

¹¹⁹ According to his family, Borden, who was diabetic and also suffered from bipolar disorder, was confused because he had not taken his insulin for several days.

incoherently as he was being removed from a police car. Once in the jail, still with his hands cuffed behind him, the same officer (Shaw) shocked Borden several more times for being “uncooperative” and failing to comply with a command to step out of his shorts or pyjama pants which had fallen around his ankles. In one statement, Shaw is reported to have said:

“... I asked Borden to lift up his foot to remove the shorts, but he was being combative and refused. I dry stunned¹²⁰ Borden in the lower abdominal area ... We got Borden into the booking area. Borden was still combative and uncooperative. I dried stunned Borden in the buttocks area”.

Borden was then reportedly pinned to the floor of the booking area and shocked again, after which he turned blue and lost consciousness. An ambulance was called and he was taken to hospital where he was pronounced dead. A statement released by the county jail authorities just after Borden's death said that “standard police procedures by trained officers to control combative or uncooperative individuals” had been used.

The autopsy report gave cause of death as consistent with “cardiac dysrhythmia, secondary to hypertrophic cardiomyopathy [abnormal thickening of the heart muscle], pharmacological intoxication and electrical shock”, with manner of death “accidental”.

A Special Prosecutor was appointed to investigate the case and, in May 2004, the officer who had used the taser on Borden was charged with two counts of battery (battery with a deadly weapon and battery causing serious bodily injury). Each charge carries up to eight years' imprisonment. Another officer present, who had pinned Borden to the ground as the last electro-shock was applied, was not charged. The trial was still pending at the time of writing.

The forensic pathologist who reviewed the autopsy for Amnesty International found that, although the concentration of the drugs ephedrine and promethazine were “apparently high”, many drugs are redistributed after death, especially after aggressive resuscitation, and that “high blood concentrations of a drug do not necessarily mean that death is caused by intoxication”.¹²¹ Noting the short time frame between the cardiac arrest, struggle and use of the taser, she gave the opinion that “death might be related to the use of the taser, in combination with his heart disease”. She noted that “people with heart disease might also die in connection with such a stressful situation without the use of a taser”. She found the “excruciating pain” invoked by the taser might also be a factor in the death of a person with serious heart disease who “may have an increased risk of death during stressful situations, including physical as well as mental stress”.

¹²⁰ This means the taser was used as a stun gun; it may have meant “drive stun”, the common term for taser use in stun-gun mode.

¹²¹ Report of Dr Sidsel Rodge, *op cit*.

- Eddie Alvarado, aged 32, died in June 2002 in Los Angeles after being tasered five times while handcuffed behind his back. The autopsy report states that "According to the history, the decedent exhibited violent and irrational behaviour. He was observed to have seizure activity and collapsed prone on the floor". The taser was used when he continued to exhibit "irrational behaviour, growling and yelling, thrusting upper torso and kicking firefighters and LAPD officers". He was placed in a "hobble restraint" (a form of hogtie) and was subsequently found to be in pulmonary arrest. Cause of death was given as "sequelae of methamphetamine and cocaine use, status post restraint, including taser use."¹²² The coroner also noted a "temporal relationship" between restraint, taser application and his cardiopulmonary arrest but found the manner of death "undetermined" (see below).
- Glenn Richard Leyba, aged 37, died in Glendale, Colorado in September 2003. According to a report on the case by the District Attorney's office, paramedics arrived at Leyba's apartment after his landlady called for an ambulance, and found him "laying face-down, rolling from side to side ... making moaning and whimpering sounds". A police officer twice used her taser on him as a stun-gun when he failed to respond to attempts to roll him over and became "physically resistant". The police report is cited as stating that the second stun mode discharge "increased his level of agitation". The same officer then fired a taser dart into Leyba's back, resulting in Leyba "moaning, screaming and 'flailing' his legs and in an increase in his level of physical agitation. It did not, however, gain Mr Leyba's compliance". Altogether, Leyba was electro-shocked in stun or dart mode at least five times, after which he "stopped all physical resistance" and was handcuffed behind his back. The report states that "while being wheeled to the ambulance, the paramedics noticed that Mr Leyba's skin color was grayish, that he had stopped breathing, and that he had no pulse". Efforts to resuscitate him were unsuccessful and he was pronounced dead in hospital.¹²³

The coroner gave cause of death as "cardiac arrest during cocaine-induced delirium".

The report from the District Attorney's office noted that there were inconsistencies in the various police and witness reports as to the mode, placement and time of taser discharges.¹²⁴ There was also disagreement about the level of Leyba's resistance. The

¹²² From autopsy report on Eddie R. Alvarado, the Department of Coroner, Los Angeles, California, 15 June 2002.

¹²³ From Officer Involved Use of Force Report, by Brian K. McHugh, Chief Deputy District Attorney, 18th Judicial District, Colorado, July 7 2004. The report reviewed written reports of the police investigation, officer and witness statements and other materials.

¹²⁴ The in-built memory chip downloaded from the taser showed that the trigger had been pulled seven times, but collectively people at the scene observed only five discharges, so the report concluded that the two additional trigger pulls must have been within the five-second default period. However, there were inconsistencies in reports of when, for how long and how many times the taser was used in stun or dart mode. There were also discrepancies in the time line due to the "variance in the accuracy of the various clocks involved".

four paramedics on the scene separately testified that he was not trying to hurt anyone and was “delirious” and kicking his feet “in no particular direction”. One paramedic noted that he appeared to be very scared and was “combative from altered mental status, not combative as if resisting”. One wrote in a “Patient Care Report” that he and another paramedic disagreed with the officer’s use of the taser “at least when it was being used in the stun mode” and that *the stun discharges “only served to further agitate Mr Leyba”* (AI emphasis). Despite these findings, the District Attorney’s office concluded that the officer’s actions did not violate any Colorado criminal statute and “constituted both a legitimate defense of others and a legitimate effort to prevent Mr Leyba from causing himself serious bodily injury”.

- Roman Gallus Pierson, aged 40, died in October 2003 in Yorba Linda, California. Police had responded to reports that a disturbed man had been running in and out of traffic. According to press reports, Pierson had run into a gas station forecourt and was rubbing ice onto his face, complaining of being hot and thirsty, when the police arrived; he was shot with a taser when he ignored an order to lie down on the pavement; while on the ground, he was tasered again when he began “grappling with police”, according to a police spokesman. He went into cardiac arrest at the scene and died in hospital. The autopsy found cause of death due to acute methamphetamine toxicity, and notes a history of coronary artery disease.
- Gordon Randall Jones, aged 37, died in Orange County Florida, in July 2002, after reportedly being jolted at least 12 times with a taser.¹²⁵ According to media reports, the taser was used after Jones became disruptive outside a hotel and “refused to leave and pulled away from deputies”. He walked with deputies to an ambulance but died on the way to hospital. Cause of death was given in the initial autopsy report as “positional asphyxia, secondary to the application of restraints in the setting of acute cocaine intoxication”. The autopsy findings noted “history of recent electrical trauma” and the Deputy Chief Medical Examiner William Anderson, who conducted the autopsy, has been quoted in press reports as stating that he believed the taser shocks contributed to Jones’ death, making it harder for Jones to breathe.¹²⁶ However, county officials requested a second expert opinion from forensic pathologist Dr Cyril Wecht who concluded that Jones had died primarily from a cocaine overdose. The independent forensic pathologist who reviewed the first autopsy for Amnesty International noted that “the concentrations of cocaine are fairly high but not necessarily lethal”, citing her previously stated concerns about the reliability of

¹²⁵ *Orlando Sentinel* 5 August 2002 and 2 October 2002 – one report states he was jolted 12 times, another states he was struck 13 times. The autopsy refers only to “Taser usage” by police and notes two areas of circular abrasions with underlying dermal thermal effect.

¹²⁶ Pathologist William Anderson, cited in media reports at the time and more recently in “Taser Safety Claim Questioned”, *Arizona Republic*, 18 July 2004

accurately measuring toxic drug levels *post mortem*. She gave her opinion that “cocaine, taser and restraint may all have played a role in his death”.¹²⁷

- Dennis Hammond, aged 31, died in Oklahoma City, in October 2003. Officers had responded to complaints by residents that Hammond was walking up and down the street and screaming at the sky. They found him sitting on top of a mailbox in a delusional state, bleeding from the legs, chest and feet. Police reportedly used a taser on him when he refused to listen to their commands. He was jolted five times in total but he pulled out the darts. He was then struck with a beanbag device before officers were able to handcuff him. Paramedics from an emergency ambulance team called to the scene were bandaging his wounds when “he turned blue and stopped breathing”. The autopsy report noted a blunt force head injury and multiple injuries to his abdomen, thighs and back, multiple abrasions and superficial cuts. Cause of death was given as “acute methamphetamine intoxication”.
- Michael Sharp Johnson, aged 32, died in Oklahoma City in November 2003. Officers responded to reports of a burglary in progress and found Johnson sitting in the living room, yelling. When he would not calm down or follow orders to get on the ground, officers shocked him five times with a taser and three others helped gain control to handcuff him. The autopsy report states: “During the brief struggle, he was ‘tasered’ multiple times before they were able to handcuff him. Approximately two minutes later he stopped breathing and EMSA¹²⁸ was called. He was transported to the emergency room in full cardiorespiratory arrest and was placed on the ventilator. ... He died approximately 22 hours and 30 minutes later”. The autopsy report gave cause of death as “acute congestive heart failure due to cocaine induced cardiac arrest,” with manner of death “accident”.
- William Lomax, aged 26, died in Las Vegas, Nevada in February 2004, after allegedly fighting with police and security guards at a housing complex. At an inquest in the case, the security guards testified that they had approached Lomax because he appeared to be overdosing on drugs, “dazed and confused”, walking in circles, lifting his shirt and sweating. A struggle followed, during which a Las Vegas police officer jolted Lomax seven times with an X26 taser in stun gun mode. Some of the jolts were applied as he was pinned face-down on the ground by four security guards who were trying to handcuff him and again when he was face-down on a gurney (stretcher). According to inquest testimony, at least three of the jolts were applied to the side of his neck, a procedure authorized during police training. When asked if the Las Vegas Police Department placed a limit to the number of shocks which could be applied, a taser training officer said:

¹²⁷ Report of Dr Sidsel Rogde, op cit.

¹²⁸ Emergency Medical Services Agency

"What we tell and train our officers is, you can use this as many times as it's going to take to get compliance".¹²⁹

Data downloaded from the taser's microchip revealed that the seven shocks were applied over a period of 9 minutes, 55 seconds, in cycles lasting, respectively, two seconds, four seconds, two seconds, six seconds, eight seconds and six seconds. A paramedic called to the scene testified that "the Taser didn't seem to have any effect. It made him angry".¹³⁰ After Lomax was placed face-down on a stretcher, officers noticed he had stopped breathing. Paramedics got his heart beating again in the ambulance and he was placed on a ventilator. He died the next day without regaining consciousness.

At the inquest, the Medical Examiner, Ronald Knoblock, testified that "cause of death was a cardiac arrest during restraining procedures", with Phencyclidine (PCP) intoxication and early bronchial pneumonia contributing factors. The pathologist found that Lomax's obesity and the fact that he was placed face-down with pressure on his diaphragm had restricted Lomax's breathing, which would already have been affected by the drugs and the physical struggle. When asked if the taser had played a role in the death, he responded:

"Yes. The tazer (sic) was used in this instance as a restraining device, and in the cause of death I incorporated that into the restraining procedures during which the cardiac arrest took place."

Dr Knoblock also observed that, while the levels of PCP in Lomax's system raised his metabolic rate, the amount of drug was "not an extremely toxic level". He added that he could not establish that the taser of itself caused the death or that Lomax would not have died without it. The inquest jury's verdict was that:

"the means by which the deceased met his death was a combination of drugs, restraining force, and the use of the tazer (sic)".

The jury also found the guards and officer's actions in restraining Lomax to be "excusable" and cleared them of wrongdoing. The Las Vegas Police Department was reported to be re-evaluating its training policies in light of the ruling.

- Frederick Jerome Williams, aged 31, died in Gwinnett County Jail, Georgia, in June 2004, after being shocked with a taser while being strapped into a restraint chair. According to media reports, police went to his home after receiving a call from Williams' nine-year-old son saying that his dad was "talking crazy" and not taking his epilepsy medication. The boy reportedly asked for an ambulance "because my dad is saying all sorts of stuff and he is hitting my mom with a belt". When police arrived, Williams called the officer "the devil" and grabbed the officer's baton and threw it at him. Despite the son's request for a "hospital truck", police arrested him

¹²⁹ From transcript of testimony at inquest held in Las Vegas on 25 June 2004

¹³⁰ transcript of inquest op cit.

and took him to jail. He was reportedly struck twice with a taser while being strapped into a restraint chair and was noticed to have stopped breathing seconds later. He died later in hospital.

The autopsy is reported to have found that Williams had died of brain damage caused by "lack of oxygen and/or blood to the brain" from a heart attack triggered during the altercation. The forensic examiners reported that "There is no evidence the Taser directly caused or contributed to his death", but were unable to determine the reasons for the heart attack.

Williams was the second person to die in Gwinnett County Jail after being tasered and strapped into a restraint chair. Ray Austin, aged 25, died in September 2003 after fighting with deputies, being shocked three times with a taser, restrained in a chair and given psychotropic drugs. He had a history of mental illness and disciplinary problems.

Following William's death, two Georgia police agencies (Macon Police Department and Forsyth County Sheriff's Department) said they were suspending their use of tasers and a third (College Park Police Department) was reported to have shelved plans to purchase them.

- Jacob Lair, aged 29, died in June 2004, following an altercation with officers in Sparks, Washoe County, Nevada, when police entered his residence to question him about an alleged theft. In September 2004, the Washoe County Coroner, Vernon McCarty, reported that Lair had died of "acute methamphetamine intoxication with associated cardiac arrhythmia while engaged in a physical struggle with law enforcement officers involving a Taser gun, pepper spray and restraints". McCarty said that the Taser was "part of the scenario" which had contributed to his death, observing that, while Lair had methamphetamines in his system, the levels "were not as high as you would normally expect" and that the death could not be called a drug overdose.¹³¹
- Willam Teasley, aged 31, died in Anderson County Detention Center, South Carolina in August 2004. According to media reports, officers used a taser to subdue him after he became violent while being booked into the jail and "shortly after he was shocked [he] stopped breathing". A preliminary autopsy reportedly showed he had died from cardiac arrest. The deputy county coroner, Charlie Boseman, is quoted as saying the taser contributed to Teasley's death, combined with a medical history that included heart disease.¹³² Teasley reportedly had other health problems, including severe brain damage resulting from an accident in 2003. The preliminary autopsy report was passed to the State Law Enforcement Division investigation team, with a final determination of manner of death pending the results of this inquiry.

¹³¹ sources: "Nevada Man Dies in Struggle with Authorities, Taser Involved", *Associated Press*, 16 September 2004; *Arizona Republic*, 17 September 2004. Amnesty International was seeking a copy of the autopsy at the time of writing.

¹³² "Pathologist says Taser contributed to jailed man's death", *Associated Press*, 23 August 2004

- Keith Tucker, aged 47, died in August 2004 in Las Vegas, Nevada – his was the second taser-related death in the city in six months (see Lomax case, above). According to media accounts, police responded to a 911 call from a roommate that Tucker was acting strangely. They found him talking incoherently and used batons and a stun gun after he allegedly punched an officer. He went into cardiac arrest at the scene and died later in hospital. In October 2004, the Clark County coroner determined that Tucker suffered a cardiac arrest brought on by the attempted restraint, including the batons and the taser. An inquest was scheduled for 22 October 2004.

2. 4. Questions regarding time lapse between taser and death or loss of consciousness in the cases reviewed

A major cause of sudden cardiac arrest is severe disturbance of the heart rhythm known as ventricular fibrillation: rapid contractions of the heart caused by irregular electrical signals in the ventricles, preventing blood from being pumped from the heart. The condition causes loss of consciousness in seconds, and death (or brain death) usually within minutes if the patient cannot be successfully resuscitated. Ventricular fibrillation can be caused by a myocardial infarction (heart attack), electrocution or drowning and, in the case of electrocution, would usually follow immediately after application of the shock.¹³³

In February 2002, Dr Robert Stratbucker, Medical Director for Taser International, reviewed three cases in which people had died after being struck with M26 tasers and held that the time delay between the application of the Taser and the deaths clearly ruled out the Taser as a cause of death. Dr Stratbucker asserted: "The only plausible cause of death from electrical injury not leaving tell-tale skin lesions – clearly not present in any of the cited cases – is ventricular fibrillation, a fatal disturbance of heart rhythm which ensues immediately upon shocking the heart with greater-than-threshold, non-Taser-like electric current pulses. Specifically, if the Taser output were to cause cardiac arrests, it would be immediate."¹³⁴

In a letter to the ACLU of Colorado in February 2004 on deaths of people struck by police tasers, Taser International reiterated Dr Stratbucker's findings, stating: "If the electrical stimulation of the TASER device were to play a causal role in the death, the death would be immediate (this has never happened)."¹³⁵

However, there are several cases in which cardiac or respiratory arrest appears to have occurred immediately or very shortly after the taser discharge, or after the last of multiple shocks. This may indicate a causal link between the taser and the death or cardiac or

¹³³ There have been several cases reported of the onset of ventricular fibrillation hours after a low voltage shock (e.g. *Journal of Critical Illness*, March 2002 "Electrical injuries: an emergency department approach; Cardiac monitoring and an ECG are essential"; Cardiac fibrillation, <http://radsafe.berkeley.edu/lsm1101appj.html>.)

¹³⁴ Reported in Taser International News Bulletin, Topic: In-Custody Deaths, February 2002.

¹³⁵ Letter to ACLU, Colorado, op cit.

respiratory arrest. Amnesty International does not have complete information on the cases and the exact time lag is not always clear in autopsy reports (which rely on police reports which themselves may not always give an exact time sequence). In some cases, autopsy reports or investigations are still pending. However, Amnesty International believes that a temporal link between the use of the taser and loss of consciousness cannot be ruled out in a number of deaths and that this issue raises a serious concern that requires further careful review and investigation by independent medical and scientific experts.

For example, in the cases cited above:

- According to reports, after the final shock, an officer noted that James Borden was no longer responsive and his face was discoloured. An ambulance was called and attempts at resuscitation failed. He was pronounced dead on arrival at hospital.
- The autopsy report in the case of Eddie Alvarado states that: "After the 5th taser application, he moved away from the mirror and prone on the floor (sic). He was then hobble-restrained. Subsequently, he was found to be in pulmonary arrest ... and was pronounced dead on arrival to the hospital". Although cause of death was given as drug intoxication, the autopsy report stated:

"The circumstances indicated a temporal relationship between restraint, including taser application, and his cardiopulmonary arrest. However, this autopsy does not provide sufficient medical evidence to conclude or exclude that taser use contributed to the death. It should be noted that after taser, the decedent was noted to have a weak pulse and agonal EKG change. Hence, the manner of death is undetermined."

- In Glenn Richard Leyba's case, a paramedic on the scene reported that Leyba "is limp after the last taser" and appears to be unconscious; after being lifted onto the stretcher he "became apnic (sic)" (non-breathing) and a monitor "confirmed pulselessness". Attempts to resuscitate him failed and he was pronounced dead on arrival at hospital.

The forensic pathologist who reviewed the autopsy for Amnesty International found that, although the coroner had ruled out the taser effect, there might well be a connection between the last taser and the handcuffing behind the back, with cocaine also being a major factor.

Several other individuals are also reported to have gone into respiratory or cardiac arrest at the scene. According to media reports, Roman Gallus Pierson, for example, was handcuffed after the second taser shot and "after about a minute, officers noticed he was not breathing".¹³⁶ Terrence Brian Hanna, who died in Canada, was tasered and "subsequently went into cardiac arrest at the scene." Frederick Williams was shocked while being strapped into a restraint chair and "seconds later" his heart stopped. William Teasley was shocked with a taser and "shortly after he was shocked, he stopped breathing".

¹³⁶ "Man Dies After Brea Police Shoot Him With Stun Gun", *Los Angeles Times* 8 October 2003. This reports only when the officers *noticed* he had stopped breathing

2. 5. Delayed death: metabolic acidosis

There has been some discussion in the medical literature of the possible effect of tasers on metabolic acidosis – a potentially fatal disturbance of the body acid-base balance.¹³⁷ Metabolic acidosis can occur in individuals who are severely agitated and this can lead to ventricular arrhythmia, especially in the presence of certain toxic drugs.

Taser International has suggested that the taser is not only safer than many weapons but can actually work to prevent metabolic acidosis because its instant incapacitation of the subject cuts short the duration of struggle and any dangerous build up of acid.¹³⁸ However, one federal study suggested that “deaths following Taser use may be related to the ability of these devices to cause increased muscle activity and decreased breathing”¹³⁹ and other studies have suggested that further research into the effects of tasers in acidosis is required (see 2.7, below). As noted above, in several of the cases reviewed by Amnesty International, the deceased continued to struggle and exhibit agitated behaviour, sometimes after repeated stunning.

An article on the effects of stun guns and tasers, published in the medical journal, the *Lancet*, in September 2001, addressed the risk of acidosis and ventricular dysrhythmias in people in states of severe agitation or physical aggression, particularly when under the influence of drugs such as phencyclidine (PCP) or cocaine. The article noted:

“The taser itself may affect acid-base balance by briefly increasing skeletal muscle activity and decreasing respiration.”¹⁴⁰

The authors reviewed one earlier study in which three people (high on drugs) went into cardiac arrest between 5-25 minutes after being hit with tasers and stated:

“By this time, taser-induced muscle contractions would no longer be present, and one would expect the individuals to be relaxing and able to breathe in a way that would compensate for a metabolic acidosis. *Such may not be the case if the individuals remained agitated or were prevented from breathing freely*” (AI emphasis).

Amnesty International believes that these concerns should be examined in the light of a number of recent taser-related deaths, particularly in cases where individuals were tasered and

¹³⁷ Metabolic acidosis is a condition in which the acid level within the blood is higher than normal; this can have a number of causes, including ingestion of toxic substances. If metabolic acidosis becomes severe, the person may develop: weakness; confusion; shock; heart problems such as arrhythmias.

¹³⁸ This was noted in a letter from Taser International to Mark Silverstein of the ACLU, Colorado, dated 26 February 2004, in response to concerns raised by the ACLU about the possibility of tasers contributing to deaths caused by metabolic acidosis.

¹³⁹ J.M. Kenny, W. Bosseau Murray, Wayne J. Sebastianelli, W. J. Kraemer, R. M. Fish, D.T. Mauager, T. L. Jones, “Human Effects Advisory Penal Report of Findings: Sticky Shocker Assessment”, *National Criminal Justice Reference Service Doc. No. 188262* (1999).

¹⁴⁰ Fish RM, Geddes LA, “Effects of stun guns and tasers”, *Lancet*, September 2001.

continued to fight or struggle, and were then hogtied or subjected to other restraint after application of taser.

2. 6. Impact of other restraints

In at least 24 of the cases reviewed, the deceased appear to have been coerced into restraint positions which can dangerously restrict breathing and have been associated with deaths in custody from “positional asphyxia”. Such positions include being held face-down on the ground with weight or pressure applied to the chest. Individuals who are obese, have underlying heart disease and/or who are severely agitated or intoxicated from drugs or alcohol are believed to be at increased risk from such procedures.

In at least eight cases, the deceased were placed in a “hogtie” or “hobble restraint”, with their wrists or elbows bound behind them to their shackled ankles. This form of restraint is considered to be a particularly dangerous and potentially life threatening procedure, especially if the subject is in a prone position.¹⁴¹ Standard-setting bodies discourage use of hogtying and urge that departments avoid holding anyone in restraints, even handcuffs, in a face-down position.¹⁴² While some US departments have banned hogtying Amnesty International is disturbed that many agencies continue to use the procedure in some form.

Four of the deceased were reportedly put into “chokeholds”: the application of pressure to the neck, constricting the flow of blood to the brain. The procedure is known to be dangerous and many departments either ban all forms of chokehold or restrict their use only to deadly force situations where no alternatives are available.¹⁴³

Several of the deceased were pepper sprayed before being tasered. Pepper spray, which acts on the mucus membranes and respiratory system, can further restrict breathing and has been associated with in-custody deaths in the USA and Canada. Amnesty International is concerned that use of multiple restraint techniques, including pepper spray, might increase the

¹⁴¹ Traditional “hogtying” involves the individual’s wrists and ankles being bound together, so that the shoulders and ankles are raised, placing pressure on the abdomen, a particularly dangerous procedure. The hobble restraint may have a longer cord between the wrist and ankles, allowing somewhat more movement, mainly to allow the individual to be transported in an upright position; while this is less dangerous, deaths have been reported from the hobble restraint, even where someone is placed on their side or upright.

¹⁴² These include U.S. Department of Justice National Institute of Justice (NIJ) Advisory Guidelines for the Care of Subdued Subjects (June 1995); *NIJ Bulletin on Positional Restraint*, October 1995; Metropolitan Police Complaints Authority (UK), bulletin July 2001.

¹⁴³ The most common forms of chokehold are the “carotid” restraint or the “lateral vascular neck” restraint both of which involve the application of pressure to the arteries in the side of the neck. Some of the largest US police agencies ban all forms of chokehold in all circumstances; these include the New York, Chicago, Philadelphia, Detroit and Houston police departments.

risk of respiratory failure.¹⁴⁴ In one case (see below), an unarmed suspect died after being pepper sprayed, electro-shocked and hog-tied.

Two prisoners (Ray Austin and Frederick Jerome Williams) died after being tasered and strapped into restraint chairs in Gwinnett County Jail, Georgia (see above). In recent years, at least 18 prisoners have died in US detention facilities after being immobilized in restraint chairs, including several who had also been struck with pepper spray and/or electro-shock weapons. The manner of restraint was found to be a primary or contributory cause of death in several cases. Amnesty International has called for a national inquiry into use of restraint chairs in the USA, based on concerns about their safety and the lack of clear regulation or monitoring of their use.¹⁴⁵

Positional asphyxia was listed as a direct cause of death in four of the cases examined, and use of restraints was noted as a contributory factor in at least six other cases. In some cases, however, restraint was not listed as a causal or contributory factor even though death or loss of consciousness appears to have occurred very shortly after the use of restraints.

Experts have noted that multiple factors may play a role in deaths where restraints have been applied, particularly if other risk factors are involved. Amnesty International is concerned that using combined techniques such as pepper spray, tasers and physical restraint could exacerbate stress levels, leading to cardiac arrhythmias. The organization believes that all the cases require further evaluation. They also underscore the need for clear protocols and training for law enforcement officers on use of restraints and how to avoid excessive or dangerous force when dealing with people with mental health problems and/or acute behavioural disturbance. Case examples include the following:

- Richard Baralla died in May 2002 in Pueblo County, Colorado. According to media accounts, police were called after he was seen acting strangely in the street and threatening to jump into traffic. The autopsy report states that Baralla, who was unarmed, was restrained

“... while exhibiting threatening behaviour. The efforts to restrain him included pepper spray, the application of a Taser stun gun device, the placement of handcuffs behind his back, as well as placement of a hobble on his legs. During the struggle, he became unresponsive....Efforts at resuscitation at the scene and hospital were unsuccessful”.

¹⁴⁴ Since the early 1990s more than 100 people in the USA are reported to have died after being subjected to pepper spray. While most deaths have been attributed by coroners to other causes, such as drug intoxication or positional asphyxia, there is concern that pepper spray could be a contributory factor in some cases. Pepper spray has been found to be a factor in several recent in-custody deaths. Studies discounting a link between physical restraint and pepper spray have generally been conducted on healthy subjects and do not replicate what happens in the field. Further research is needed.

¹⁴⁵ See, for example, Amnesty International report: *The Restraint Chair: How Many More Deaths?* AI Index AMR 51/31/2002

Although the coroner noted that on Baralla's body there were "two sets of electrical injury consistent with Taser application", he found that they were "not of sufficient severity to have contributed to the death."¹⁴⁶ The autopsy also found "there was no evidence of natural disease which could be considered a contributing cause of death" and the toxicology results were "essentially negative". The opinion also noted: "Witness statements did not suggest a significant asphyxial component". The coroner attributed the death to "cardiac arrest occurring during excited delirium necessitating restraint." A wrongful death lawsuit has been filed by Richard Baralla's family, claiming police used excessive force.

The forensic pathologist who reviewed the autopsy for Amnesty International considered that the taser may have been a factor, along with the use of restraints, noting a temporal relationship between the restraint, use of taser and cardiac arrest. She found that the absence of any asphyxial component, if true, may increase the significance of the taser. She also noted that the heart was somewhat enlarged (something not commented on in the autopsy report) – another possible risk factor for adverse reaction to electro-shock.¹⁴⁷

- Vincent Del'Ostia, aged 31, died in January 2002 in Broward County, Florida. According to the autopsy report, he had a history of psychosis, drug abuse and asthma. Police were called after he had caused a disturbance in the lobby of a motel and found him banging on the motel door. He was "reportedly agitated, incoherent and perspiring". He continued to flail about after being tasered and to strike at officers with his hands and feet while on the ground. Officers rolled him onto his stomach, placing handcuffs on his wrists and ankles, after which an officer "placed his foot on the upper mid-back to keep him from rolling back over. Paramedics arrived within approximately 30 seconds of his being restrained and observed he had stopped breathing and was unresponsive". According to a press article, a motel employee said that when the police arrived, he saw them "kicking and teasing" Del'Ostia and asked them to take it easy on him. Cause of death was determined to be cocaine toxicity.
- Eddie Alvarado (see above) was hobble restrained after being tasered for the fifth time while lying prone on the floor and was subsequently (at the scene) "found in pulmonary arrest".
- Terry Hanna, aged 51, died in Burnaby, Canada, in April 2003 after being shot with a taser. Police said they used the taser on him when he became "aggressive" when they tried to get him out of a police car. He went into cardiac arrest at the scene. The coroner found cause of death to be "acute cocaine intoxication", with coronary artery disease and restraint to be contributory factors. The autopsy report noted that it was "of significance ... that the patient was placed face-down, handcuffed behind his back

¹⁴⁶ It is unclear what the coroner meant by this, as the external marks from taser burns bear no relation to the effect the shocks may or may not have on the heart.

¹⁴⁷ Dr Sigdel Rogde's report to Amnesty International (op cit).

and hogtied during the restraint process.”¹⁴⁸ An inquest in the case was still pending at time of writing.

- Walter C Burks, aged 36, an unarmed, homeless man, died in Minneapolis, Minnesota, in August 2003. According to a report from a community group, based on a review of police records, Burks had entered a convenience store shirtless and sweating, “looking frightened” and begging for help, saying he was going to die.¹⁴⁹ After he grabbed an employee on the shoulders, staff and customers took him to the ground and tried to calm him while police were called. When the police arrived he was lying face-down on the floor with his right arm tucked under his torso. When he failed to respond to police commands to get up, he was sprayed in the face with pepper spray. He was handcuffed behind his back and dragged to a police car, still unresponsive. Officers lifted his upper body into a police car, and when he still failed to respond, tasered him twice in the lower back with an M26 in touch-stun mode. He was placed face-down on the back of the police car, handcuffed behind his back with his legs bent backwards (effectively in a hobble restraint position), and reportedly left in that position for some 27 minutes. He was wheeled into hospital in a wheelchair and staff noted him to be “drooling and still unresponsive”. He was pronounced dead a short while later. The Hennepin County Medical Examiner reportedly ruled his death to be “sudden, unexpected death associated with cocaine excited delirium”, with heart disease and pulmonary emphysema underlying health factors.
- Louis Morris, aged 50, died in Orange County, Florida in October 2003 as police tried to arrest him for suspicious behaviour in a grocery store car park. According to media reports, he died “just minutes after Orange County sheriff’s deputies used a Taser stun gun on him”. The autopsy found *inter alia* that he had a “history of bizarre, excited, paranoid behaviour prior to sudden arrest” and that he went into cardiac arrest “after being restrained with handcuffs and ankle restraints (hobbled)”. There was no evidence of significant external trauma or internal injury. He had a high concentration of cocaine in his system, and the cause of death was listed as “cocaine excited delirium”.

The forensic pathologist who reviewed the case for Amnesty International questioned the finding of “cocaine excited delirium” as this is a condition that cannot be diagnosed by autopsy without the history and circumstances being taken into account. She also found that, although he had relatively high levels of cocaine in his system, the distribution of this in the body may have been affected by resuscitation. Although it was impossible to assess the role of the taser on the information provided, she believed it could not be ruled out as a contributory factor, along with the restraint.

¹⁴⁸ Autopsy report in case of Terrence Hanna, July 2003

¹⁴⁹ *Communities United Against Police Brutality* “The Death of Walter C. Burks, An Analysis of Police Actions”, April 12, 2004

- Kevin O'Brien, aged 31, died in Pembroke Pines, Florida, in November 2003. According to his attorney he was mentally disturbed, unarmed and half naked (dressed only in swimming shorts) when arrested for beating on cars. He was tasered multiple times and placed in a hogtie restraint. The autopsy report gave cause of death "positional asphyxia due to 'hogtying' and facedown (prone) restraint in an individual displaying 'excited delirium'". In his report, the Medical Examiner noted the known danger of sudden respiratory arrest caused by this procedure, especially in the case of individuals involved in a violent struggle or strenuous exercise. However, he found "There is no evidence of illegal behaviour by police, as hogtying (hobbling) face down (prone) restraint is not prohibited by Florida's laws. The Medical Examiner concurs with the policy of the Pembroke Pines Police Department that hobble restraint ("hogtying") should not be used". At the time of writing, Amnesty International was seeking information on whether any disciplinary action was taken against the officers involved, after they were cleared of criminal wrongdoing.
- Lawrence Davis, aged 27, died in Phoenix, Arizona, in August 2004. According to press reports, he was involved in a struggle with officers after he jumped onto a parked patrol car, yelling incoherently. He continued to struggle after being hit with taser darts, and police tasered him again in the leg after bringing him to the ground. An officer then used a "chokehold" on him. He was pronounced dead in hospital about 45 minutes later.

2.7. Taser and pregnancy

One of the cases included in Amnesty International's review was the death of an unborn child in December 2001 after the pregnant mother was struck by an M26 taser. Although the coroner failed to establish a link between the taser and the foetal demise, the mother subsequently received substantial damages in an out-of-court settlement (see Cindy Grippi case under **Lawsuits, 1.7.** above). Two medical experts consulted by the woman's lawyer reportedly found a likely causal connection between the foetal death and the electro-shock.

Taser International warns that police use of tasers is "not advisable" in the case of pregnant women because of the risk of the woman falling. Otherwise, the company maintains that the electrical output from tasers is not harmful to a foetus. However, Amnesty International is concerned by the absence of thorough, independent research into the medical effects of using low-amperage, high voltage taser shocks on pregnant women. One past study has suggested an association between electrical injury from a (low powered) taser and miscarriage after reviewing a case report and the literature on electrical injuries during pregnancy.¹⁵⁰ The case concerned a woman 12 weeks pregnant who was shot with a taser after she refused to submit to a strip search in a Florida jail; she began to miscarry

¹⁵⁰ Mehle L.E. "Electrical Injury from Taser and Miscarriage", *Acta. Obstet Gynaecol Scand*, 1992; 71:118-23.

spontaneously seven days later. She was subsequently awarded \$225,000 by a federal jury.¹⁵¹ A study of the safety of tasers and any associated medical risks should include further research into this topic.

2.8. General concerns about health risks and tasers

The manufacturers of electro-shock equipment claim their products are medically safe. It has been emphasized that the electrical output/current of even the higher powered tasers is far below the threshold for which cardiac ventricular fibrillation (severe disturbance of the heart rhythm during which the heart pumps little or no blood) could occur. A training manual produced by Taser International states that "the Advanced Taser's low electrical amperage and short duration of pulsating current, ensures a non-lethal charge". According to Steve Tuttle, director of government affairs for Taser International: "In 30 years, no death has ever been attributed directly to the Taser gun, typically it's cocaine, pre-existing medical conditions and, in some cases, excited delirium".¹⁵² Company literature suggests that tasers are safe even for people fitted with heart pacemakers.

However, there remains a lack of rigorous, independent research into the medical and safety effects of stun weapons. While there is a limited amount of literature describing clinical experience of earlier tasers, there has been no independent medical literature published to date on the effects of the more powerful Advanced Taser. The only medical studies prior to the marketing of the Advanced Taser were tests on animals commissioned by the company; none of these studies has been peer reviewed.¹⁵³

The earlier published literature includes a review of 16 deaths occurring in Los Angeles between 1983 and 1987, all involving people struck by the original low-powered tasers.¹⁵⁴ In only one case did the authors find the taser may have contributed to the death of a man who already had a severely debilitated heart (in all other cases they found cause of death was clearly due to other factors, mainly drug intoxication). The findings were challenged by forensic pathologist Dr Terrence B. Allen, who expressed concern that certain medical conditions, including drug use and heart disease, may increase the risk that the taser will be lethal and found it could have contributed to nine of the deaths.¹⁵⁵

Medical experts have continued to question the safety of tasers, particularly on people with underlying heart problems or other conditions. A report in the international medical

¹⁵¹ Orlando Sentinel June 16, 1991

¹⁵² *The Olympian* 11 November 2002

¹⁵³ The US Department of Defense is reportedly conducting an ongoing study, based, in part, on materials by Taser International, including operational use, but the results have not yet been made public.

¹⁵⁴ (R. Kornblum, M.D., S. Reddy, M. D, "Effects of the Taser in Fatalities Involving Police Confrontation," 36 *Journal of Forensic Sciences*, 434-48, 1991).

¹⁵⁵ 37 *Journal of Forensic Sciences*, 956-58, 1992

journal the *Lancet* in September 2001, for example, reviewing the available medical literature, noted that tasers were less likely than guns to cause injury or death and that tests on pigs suggested that “cardiac myocardial ... stimulation is extremely unlikely in normal use of these devices”.¹⁵⁶ However, the authors found that “Further research on what other cardiac effects tasers and related devices would have in people with pacemakers is needed”.¹⁵⁷ They concluded that:

“... apart from issues related to cardiac pacemakers mentioned above, there are others that still need to be researched. Injury thresholds need to be studied, as do the effects of tasers on the nerves. Methods of stratifying people at risk of respiratory or cardiac arrest should also be examined, as well as the degree of blood-gas correction needed to minimise this risk.”

The UK Defence Scientific Advisory Council Subcommittee on the Medical Implications of Less Lethal Weapons (DOMILL), reporting to the UK Home Office in December 2002, also raised concern about the potential and unknown medical risks from tasers, although a decision was made in January 2003 to pilot the M26 in the UK under limited circumstances (see below). This followed a two-year review of the operational and medical aspects of the various taser models available. The DOMILL experts noted that:

“The body of manufacturers’ experimental evidence from biological models of the ... effects of taser on excitable tissues is not substantial, particularly with regard to the M26; the peer-reviewed evidence is even more limited.”¹⁵⁸

While they found, on the available evidence, that the risk of death from primary injuries presented by the M26 taser was low, and very much lower than from conventional firearms, DOMILL observed that:

“The confidence of the opinion of a very low risk from future use of the M26 is not as high as that for the low-power device”. This was due in part to the “dearth of information on the potentially adverse electrophysiological effects of the higher current flow in the body, particularly in subjects who have a predisposition to cardiac arrhythmias arising from drug use, pre-existing heart disease or genetic factors”.¹⁵⁹ DOMILL also noted:

“There is no experimental evidence that the aforementioned pro-arrhythmic factors increase the susceptibility of the heart to low or high power Tasers specifically, sufficient to cause an arrhythmic event. *Nevertheless, there is sufficient indication from the forensic data and the known electrophysiological characteristics of the heart (and the effects of drugs on this) to express a view that excited, intoxicated individuals or those with pre-existing heart*

¹⁵⁶ R.M.Fish, L.A. Geddes, “Effects of stun guns and tasers”, *Lancet*, September 2001, op cit.

¹⁵⁷ The early medical literature includes concern about the potential of tasers to disrupt the software or cable in pacemakers: Koscove ME. “The Taser Weapon: a new emergency medicine problem”, *Annals of Emergency Medicine*, 1985; 14:1205-8.

¹⁵⁸ *First DOMILL statement on the medical implications of the use of the M26 Advanced Taser*, December 2002

¹⁵⁹ *Ibid*, paragraph A18

disease could be more prone to adverse effects from the M26 Taser, compared to unimpaired individuals" (AI emphasis) (paragraph A28 of the DOMILL report).

The DOMILL experts recommended that further research should be undertaken into "cardiac hazards associated with use of the taser on individuals who could be considered to have a greater risk of adverse effects", including "possible hypersusceptibility to taser currents arising from drugs commonly used illegally in the UK, acidosis and pre-existing disease".¹⁶⁰ They conceded, however, that approval for piloting the M26 taser, under the strict terms of the operational guidance issued by the Association of Chief Police Office (ACPO), could be considered pending such further research.

Five UK police forces subsequently introduced trials of the M26 taser under the ACPO guidelines: these allow tasers to be deployed only by trained officers in situations where use of a firearm has been authorized. In the UK most police officers do not carry, and are not trained to use, firearms. Firearms remain in the firearms box and are only issued to officers when authorized for specific circumstances.¹⁶¹ In September 2004, the UK Home Secretary, David Blunkett, announced that, in light of the outcome of the trials, he would allow chief officers of police forces across England and Wales to deploy tasers "for use in the same strictly limited circumstances" as set out in the APCO guidelines.¹⁶²

The announcement followed an updated report by DOMILL, which considered data from the UK trials, as well as some further limited research into the effects of electrical pulses and of certain recreational drugs on the heart. While the report concluded, overall, that the risk of life-threatening or serious injuries from the M26 Taser was very low, it left unchanged the earlier caveat set out under paragraph A28 (cited above) that "excited, intoxicated individuals or those with pre-existing heart disease could be more prone to adverse effects from the M26 Taser". The report states:

"DOMILL has reviewed the paragraph in its first statement that discussed pro-arrhythmic factors (paragraph A28) and concludes that it does not require modification on the basis of the current work. The current work provides experimental evidence to support the original statement."¹⁶³

¹⁶⁰ *Ibid*, paragraph A30 (b)

¹⁶¹ The ACPO guidelines state that "Authorized Firearms Officers (AFOs) ... are issued with firearms where the authorising officer has reason to suppose that they, in the course of their duty, may have to protect themselves or others from a person who is: in possession of a firearm or has immediate access to a firearm, or is otherwise so dangerous that the officer's use of a firearm may be necessary". (*Operational Guidance on use of Taser*, ACPO, 13 August 2004, p 3)

¹⁶² During the year-long pilot study, tasers were deployed by UK police in 60 incidents but fired on only 13 occasions, resulting in minimal injury.

¹⁶³ *Second statement on the medical implications of the use of the M26 Advanced Taser*, DOMILL, July 2004, page 3. This current work included research into the effect of recreational drugs on cardiac function. DOMILL reported that the "results from the study ... suggest that some frequently abused drugs have the potential to contribute to any cardiac-related morbidity or mortality that may arise in the context of Taser use. Furthermore, it seems reasonable to assume that this conclusion could be

The ACPO operational guidance for taser use in the UK deals with these risk factors by limiting tasers only to authorized situations where trained officers might otherwise use a firearm, and by instructing officers to take them into account when determining the appropriate options.¹⁶⁴ The guidelines also recommend immediate referral to hospital of any tasered suspect who has been fitted with a pacemaker or cardiac device and state that "all arrested persons who have been subjected to discharge of a taser must be examined by a Forensic Medical Examiner as soon as practicable".¹⁶⁵

A review of the medical literature commissioned by Taser International also raised a number of questions about safety issues and the Advanced Taser.¹⁶⁶ The authors pointed to the lack of clinical medical literature on recent models and absence of conclusive evidence on the effects of the electrical discharge from tasers on humans. They expressed the view that it will be

"difficult to determine absolute safety for any given quantity or nature of electrical energy delivered by these weapons. On one hand, direct discharges into animal heart muscle did not cause ventricular fibrillation, but in earlier (disputed) work, short episodes of cardiac standstill were caused and doubts raised about the effectiveness of pacemakers under Taser stimulation".

They also wrote that:

"elderly subjects and those with pre-existing heart disease are perhaps at an increased risk of cardiac complications and death following exposure to large quantities of electrical energy. Since the elderly and heart patients don't often require to be subdued or controlled with a high level of force, then this is unlikely to pose a common problem" and that

"There is not enough proof either way to determine the risk to those with implantable defibrillators or pacemakers".

generalised to other emotionally charged and possibly violent confrontations with law enforcement personnel." (*ibid* at page 3)

¹⁶⁴ The guidance states that "where it becomes apparent that the subject has an existing medical condition or is under the influence of drugs, assessment of these additional risk factors should be made on determining the appropriate option."

¹⁶⁵ The guidelines also state that "Close monitoring of a subject throughout the period following application of the taser is of utmost importance. If the person is detained in a cell they should be subject to the same cell supervision provided for persons who have consumed alcohol or drugs. If there are any signs of adverse or unusual reactions then medical attention should be provided immediately and if necessary this must be given precedence over conveying the subject to the police station".

¹⁶⁶ The review was conducted by Dr Anthony Bleetman (Consultant in Accident and Emergency Medicine, Birmingham Heartlands Hospital, UK and Honorary Senior Clinical Lecturer, Dept of Surgery, University of Birmingham, UK) and Dr Richard Steyn (a Consultant in Thoracic Surgery, Birmingham Heartlands Hospital, Birmingham, UK). Their findings have been published as *The Advanced Taser: a Medical Review*, Bleetman and Steyn, April 27 2003 (available at the Taser International web-site).

Notwithstanding the potential medical risks described, the authors found that the taser had a "lower injury potential for prisoners than current use of unarmed defensive tactics, baton strikes and deployment of police dogs" and that "stun devices are certainly less lethal than firearms and if they are to be deployed in similar circumstances and level of threat, then the outcome will almost certainly be safer".

The authors also noted that at that time no deaths had been linked conclusively to the taser, and that "All deaths have occurred whilst in custody after Taser electrical delivery rather than during or immediately afterwards". However, as described above, Amnesty International believes the latter claim may not be the case in a number of more recently reported deaths.

An article published in the *Emergency Medical Journal (EMJ)* in 2004 on the implications for the Advanced Taser in British policing, authored independently by the above two experts, covered similar ground and stated that "Until clinical experience with this new device is published, it is only possible to draw general conclusions about the relative safety of the device" and that "It seems that the device is essentially safe on healthy people".¹⁶⁷ The authors suggested management of "tasered" patients in emergency departments, noting *inter alia* that "important points in the history will include known cardiac disease, including implanted pacemaker or defibrillator, pregnancy, drug or alcohol intoxication, bizarre behaviour at the time of arrest, other psychiatric disturbance, or coincidental medical problems". On the risks of electrical injury, the article noted "there is no evidence to date that this form of electrical delivery causes interference with cardiac or neurological function in the 30,000 volunteers or in the reported operational uses". However, the authors refer to "only four reported deaths" in about 40,000 operational uses, in which "no direct association with Taser use was implicated". Amnesty International believes that the more than 70 deaths reported since those materials were reviewed, and factors arising from those cases, provides ground for urgent independent scrutiny, as does data on alleged unwarranted injuries, excessive force and ill-treatment.

The studies cited above underscore Amnesty International's concern about the potential health hazards for serious unwarranted injuries and death that may ensue from widespread deployment of the M26 or X26 taser. While the *EMJ* review gives the opinion that tasers are essentially safe on healthy people, many tasered individuals are far from healthy. Operational surveys by law enforcement agencies in North America show that more than half the number of people confronted by the M26 Advanced Taser were impaired by alcohol, drugs or mental illness -- among the population identified by some medical experts as potentially at increased risk of adverse effects such as heart arrhythmias and "acidosis". As

¹⁶⁷ A Bleetman, R Steyn, C Lee. "Introduction of the Taser into British policing. Implications for UK emergency departments: an overview of electronic weaponry", *Emerg Med J.* 2004; 21: 136-140 (accepted for publication June 2003)

taser use proliferates, the potentially adverse effects on people with heart disease or other underlying conditions could become a significant concern.¹⁶⁸

It is important to note also that deaths have been linked with other high-voltage stun weapons in the USA. An autopsy found that a foster mother's use of a 70,000 volt stun gun on a malnourished seven-month old infant was a direct cause of his death, with the case report concluding that "stun guns are dangerous weapons".¹⁶⁹ An autopsy in the case of a 54-year-old man killed during a botched robbery in August 2002 ascribed cause of death as "Electrocution due to a stun gun"; the autopsy found "Factors contributing to his death are Hypertensive Cardiovascular Disease, Coronary Atherosclerosis, and Cirrhosis of the Liver."¹⁷⁰

An Ultron 11 stun gun, discharging 45,000 volts at 6 milliamps, was found to be a contributory factor in the death of Virginia prisoner Larry Frazier. Frazier, a diabetic, died in July 2000 after lapsing into a coma in the prison infirmary while suffering from hypoglycaemic shock. Guards in the infirmary applied the stun gun to him three times after he allegedly became "combative" during a medical examination. The autopsy report gave cause of death as "cardiac arrhythmia due to stress while being restrained following stunning with Ultron 11 device". The coroner did not find the electro-shock from the Ultron 11 caused death directly through ventricular fibrillation, noting that "it was applied on the flank, where the output would not interfere with the heart's electrical activity" and that, according to witnesses, "the decedent continued to thrash about and shout for several minutes after the device was used". Instead, she concluded,

"It seems most likely that severe physiologic stress, initiated by hypoglycaemia and exacerbated by decedent's prolonged agitation with stunning, was sufficient to induce a lethal cardiac arrhythmia", adding that "Individuals with coronary artery disease are at increased risk for such an event" (Frazier had severe atherosclerosis).¹⁷¹

¹⁶⁸ Data from US Department of Health and Human Services, published in July 2004, showed that 11% of US adults aged 18 and over had ever been told they had some form of heart disease and 13 million (6%) had been diagnosed with coronary heart disease. This figure does not include those with undiagnosed heart problems.

¹⁶⁹ Turner MS, Jumbelic ML, Case Report: Stun Gun Injuries in the Abuse and Death of a Seven-Month-Old Infant, *Journal of Forensic Sciences* 2003, 48: 180-2.

¹⁷⁰ Report of Coroner, Will County, Illinois, in case of Jose Guadalupe Garcia.

¹⁷¹ Report of Autopsy in case of Larry Frazier, Office of Chief Medical Examiner, Commonwealth of Virginia, July 2000.

3. CONCLUSIONS AND RECOMMENDATIONS

Tasers are widely promoted by US police agencies as being a useful force tool, safer than many other weapons or techniques used to restrain dangerous, aggressive and focused individuals. In practice, however, they are commonly used to subdue individuals who do not pose a serious and immediate threat to the lives or safety of others. In many reported instances police actions using tasers appear to have breached international standards on the use of force as well as the prohibition against torture or other cruel, inhuman or degrading treatment or punishment.

Amnesty International considers that electro-shock weapons are inherently open to abuse as they can inflict severe pain at the push of a button without leaving substantial marks, and can further be used to inflict repeated shocks. While the capacity for abuse exists in whichever mode tasers are deployed, Amnesty International believes that tasers in "touch" stun gun mode are particularly open to abuse, as they are designed for "pain compliance" and tend to be used against individuals who are already in custody or under police control, often with multiple shocks.

Amnesty International is further concerned that, despite being widely deployed, there has been no rigorous, independent and impartial study into the use and effects of tasers. Medical opinion has continued to raise concern about potential health risks from tasers, particularly in the case of people suffering from heart disease, or under the influence of certain drugs. Amnesty International's concerns are heightened by a growing number of deaths of individuals struck by police tasers. The organization believes that the taser cannot be ruled out as a possible contributory factor in some deaths. Concerns about the risks associated with tasers increase as they become more widely deployed.

Many police agencies claim that tasers have the potential to save lives or avoid serious injury in cases where police officers might otherwise resort to firearms or other forms of deadly force. It is self-evident that tasers are less-lethal or injurious than firearms. Amnesty acknowledges that there may be situations where tasers can effectively be used as "stand-off", defensive weapons as an alternative to firearms in order to save lives. This appears to be the aim of the limited introduction of tasers to UK police who operate under strict rules. However, it appears that in practice tasers are rarely used as an alternative to firearms in the USA and most departments place them at a relatively low level on the "force scale". Amnesty International further notes that measures such as stricter controls and training on the use of force and firearms are likely to be more effective overall in reducing unnecessary deaths or injuries.

Based on these considerations, Amnesty International makes the following recommendations to federal, state and local authorities:

1. Suspend all transfers and use of tasers and other electro-shock weapons pending a rigorous, independent and impartial inquiry into their use and effects. Such an inquiry should be carried out by acknowledged medical, scientific, legal and law enforcement experts who are independent of

commercial and political interests in promoting such equipment. They should rigorously assess their medical and other effects in terms of international human rights standards regulating the treatment of prisoners and use of force; the inquiry should include the systematic examination of all known cases of deaths and injury involving the use of such weapons and also consider the mental impact of being subjected to electro-shock. The study should recommend strict rules, safeguards and oversight procedures to prevent misuse of any types of electro-shock equipment that may be viewed as having a legitimate use in law enforcement. A report of the findings of such an inquiry should be made public promptly after completion of the study.

2. International standards recognize that situations will arise in which police officers will have to use force. However, these standards, specifically the (UN) Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, set specific guidelines on when, how and the extent to which force can legitimately be used. All law enforcement agencies should ensure that officers are trained to use force strictly in accordance with these standards.¹⁷²
3. Federal, state and local authorities should ensure that use of force training programs for law enforcement officials include international standards on human rights, particularly the prohibition against torture and cruel, inhuman or degrading treatment or punishment.
4. All allegations of human rights violations and other police misconduct should be fully and impartially investigated. All officers responsible for abuses should be adequately disciplined and, where appropriate, prosecuted.

Where law enforcement agencies refuse to suspend their use of tasers, pending the outcome of the above-mentioned inquiry, Amnesty International recommends that:

5. departments using tasers should strictly limit their use to situations where the alternative would be use of deadly force. Examples would include: armed stand-offs, instances in which a police officer faces a life-threatening attack or injury, or threat of attack with a deadly weapon, or where the target presents an immediate threat of death or serious injury to him/herself or others. In such circumstances, tasers should be used only where less extreme measures are ineffective or without a promise of achieving the intended result.

¹⁷² These require *inter alia* that law enforcement officials shall, as far as possible, apply non-violent means before resorting to the use of force and firearms; exercise restraint in such use and act in proportion to the seriousness of the offence and the legitimate objective to be pursued; minimize damage and injury, and respect and preserve human life. Law enforcement officials shall not use firearms except in self-defence or the defence of others against the imminent threat of death or serious injury; in any event, intentional lethal use of firearms may only be made when strictly unavoidable to protect life. (See appendix for extracts from the standards)

6. Unarmed suspects should not be shot with a taser for arguing or talking back, being discourteous, refusing to obey an order, resisting arrest or fleeing a minor crime scene, unless they pose an immediate threat of death or serious injury that cannot be controlled through less extreme measures.
7. Operational rules and use of force training should include a prohibition against using tasers on the following groups, except as a last resort to avoid deadly force when no alternatives other than firearms are available: pregnant women; the elderly; children; emotionally disturbed persons or people who are mentally or physically disabled; people in vulnerable positions where there is a risk of serious secondary injury (e.g. in dangerously elevated positions, or near flammable substances); people under the influence of drugs.
8. Repeated shocks should be avoided unless absolutely necessary to avoid serious injury or death.
9. Departments should introduce guidelines which prohibit the application of prolonged shocks beyond the five-second discharge cycle.
10. Tasers should only be used in stun gun mode as a back-up to dart-firing tasers and only when no other options are available to an officer and there is an immediate threat of death or serious injury to the officer, the suspect or another person. The stun gun function should never be used to force a person to comply with an order given by an officer where there is no immediate threat to the life or safety of the officer or others.
11. Whenever an individual has been shot with a taser, police officers or custody staff should be required to call paramedics or other medical professionals to administer treatment. It is advisable to take tasered subjects to hospital to have the barbs removed and to monitor for other adverse effects.
12. Federal, state and local agencies should ensure strict reporting by the departments concerned on all use or display of tasers, with regular monitoring and data made public. In particular:
 - Departments should download data recorded by officers' tasers after every incident in which they are used. A summary of this data should be included in all use of force reports.
 - Each display, "sparking" or shock administered by a taser should be reported in use of force reports, as well as whether the taser was used in dart-firing or stun gun mode and the reasons why a taser was used. The number of trigger-pulls and duration of the shock should be reported in each instance. The age, race and gender of each person against whom a taser is deployed should also be reported.
 - Prisons and other institutional facilities should install remote monitoring equipment to record taser usage automatically as it occurs.

- Each department should provide a detailed break-down of its taser use in regular, public reports.

Recommendations on private sale or use of tasers

13. Tasers and electro-shock weapons should not be sold to members of the public whose use of the device cannot be monitored, constrained or accounted for.
14. In jurisdictions where officials refuse to ban their sale, all tasers and electro-shock weapons sold to the public should be registered with local officials.
15. The same restrictions on firearms purchased by convicted felons or individuals convicted for domestic violence, should apply to electro-shock weapons sales.
16. The sale of tasers should be regulated as firearms, even though they use compressed gas rather than gunpowder. Federal, state and local officials should set strict guidelines to curtail abuse of electro-shock weapons available to the public, with strict penalties imposed for unlawful use of such weapons.

Additional recommendations:

17. Mentally ill or disturbed individuals should receive appropriate treatment and alternatives to force in line with best practice. Where officers have reason to believe that a disturbed individual may be acting in a violent or threatening manner as a result of mental illness, efforts should be made to involve mental health specialists in dealing with the disturbed person. Policing methods based on force should only be used as a last resort.
18. Dangerous restraint holds such as hogtying and use of carotid neckholds or chokeholds should be banned.
19. There should be strict limitations and guidelines on the circumstances in which pepper spray should be used, with clear monitoring procedures.

4. APPENDICES

4.1. Appendix 1: Taser deaths in USA and Canada June 2001 - 4 Oct 2004

Name/ source indicated if autopsy (AUT)	Police agency/ City/ State Month/ Year of death	Cause of death	Contrib. factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Mark Burkett Age 18 (Un) (Taser+Press only)	Alachua County Sheriff's Office Alachua County FL 17 th June 2001	ME stated cause of death was "acute exhaustive mania"	Blood alcohol reading of 0.11 14 hours after arrest- (legal driving limit 0.8). Family history of paranoid schizophrenia (Press	Poss 2x		Became unresponsive the day of taser use-Wednesday. Died 4 days later- Sunday. (Press report)
Hannah Rogers-Grippi 26-week-old female foetus, died in womb after mother, Cindy Grippi, hit with police taser	Chula Vista Police Department, CA 12 December 2001	ME found "exact cause of the intrauterine death is unclear but could be related to the maternal methamphetamine use" (2 medical experts for the plaintiff in subsequent lawsuit gave opinion that likely cause of death the electrical shock. Mother awarded substantial damages in out-of-court settlement)	ME found placental infarct in small proportion of placenta. Toxicology tests on foetus revealed "a significant amount of methamphetamine", no other drugs detected. Foetus was of normal gestational weight and no evidence of disease or trauma. Experts for plaintiff found tearing between placenta and uterus could be caused by electrical current.	1x (two darts extracted from mother's back)		Foetal heartbeats documented at a hospital approx. 2 hrs after the taser incident, used by ME to likely exclude taser as COD. The accuracy of the foetal heartbeat finding questioned by experts for plaintiff in subsequent lawsuit, noting hospital had trouble detecting them and that they could, in fact, have been the mother's. Mother reports lack of foetal activity from just after the taser incident. The day after the taser incident, 12 December, mother diagnosed with foetal demise and baby delivered by induction stillborn 3 days later.
Marvin Hendrix Age 27 (B) (AUT)	Hamilton PD Ohio 17 th December 2001	Cocaine toxicity	Possible restraint/excited delirium	2x "exact role unknown"	History of restraint (autopsy, but no details)	"some 2 minutes" (went into cardiac arrest in ambulance)
Vincent Del'Ostia, Age 31 (W) (AUT)	Hollywood PD Broward County FL January 2002	Cocaine toxicity (signs excited delirium)	History of drug abuse and schizophrenia.	2x	Prone (face-down), handcuffed/behind back + ankle cuffs	Still struggling after taser strike. Officer observed had stopped breathing 30 secs after restrained
Anthony Spencer Age 35	Philadelphia PD February 2002	Press reports coroner finding of cocaine overdose			Pepper spray before tasered	"conscious and talking on way to hospital" at first but died on way to hospital

Name/ source - indicated if autopsy (AUT)	Police agency/ City/ State Month/Yea r of death	Cause of death	Contrib.factors/ Underlying health condition	No. Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Henry William Canady Age 46 (B) (AUT)	Nassau County FL March 2002	Cocaine toxicity and coronary atherosclerosis	Heart disease			
Richard Baralla Age 36 (HISP) (AUT)	Pueblo, Colorado May 2002	Sudden cardiac arrest during excited delirium necessitating restraint	Chronic thyroiditis, obesity no physical signs of asphyxia, nor an asphyxial component according to witnesses) witnesses) NB coroner notes history of drug abuse but toxicology reports show no alcohol or drugs in system	2x	Pepper spray handcuffs/hobble (hogtied)	Went into arrest at scene, efforts at resuscitation at scene and at hospital were unsuccessful and he was pronounced dead a short time later
Eddie R Alvarado Age 36 (HISP) (AUT)	LAPD Los Angeles CA June 2002	Death caused by sequelae of methamphetami ne and cocaine use, post restraint and taser use.	No coronary problems, hyoid bone and larynx intact but severe respiratory congestion	5x Autopsy report states: "The circumstances indicated a temporal relationship between restraint, including taser application, and his cardiopulmonary arrest"	Handcuffed behind back when struck with taser then hobble (hogtied)	"Temporal relationship" between restraint, inc. taser and pulmonary arrest, (became prone after 5 th application. Then hobble restrained. Subsequently found in pulmonary arrest and dead on arrival at hospital.)
Jason Nichols Age 21 (B) (AUT)	Oklahoma City, OK June 2002	ME determined Nichols had died of head trauma suffered during fight with uncle	Multiple contusions, lacerations and abrasions. 3 lacerations to back of head No evidence of natural disease no drugs found "extremely unlikely that the taser events had a direct effect or were responsible for death (acc autopsy)	At least 2x Taser implantation sites at right upper arm and left upper abdomen	Pepper spray/handcuffs. Constantly struggled against restraints ie in restraints	Officer rather than EMSA drove him to hospital. Went into cardiac arrest 5 mins after arriving at hospital.
Name unknown (Taser Int CNN List)	Phoenix, AZ June 2002		Police found man bloodied in driveway	Conflicting reports.		When paramedics arrived he went into cardiac arrest i.e. at scene, and died in hospital

Name/source indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Clever Craig Age 46 (Taser Int, Press)	Mobile, Alabama June 2002	"cardiac dysthythmia during..excited delirium and following electrical shock from Taser"	(history mental health problems) Pre-existing heart problem No trace of recreational drugs in system.	3x COD indicates temporal link between cardiac arrest and shock.		Died shortly after struggle with police. Autopsy notes arrhythmia occurred after electrical shock.
Fermin Rincon Age 24 (HISP) (AUT)	Fontana CA 27 th June 2002	Acute cardiac arrhythmia, due to methamphetamine abuse, years.		3x	Punched, put in chokehold or "lateral vascular neck restraint" Press: subdued by 5 police officers	Stunned with taser, punched and put in chokehold before collapsing.
Johnny Lozoya	Gardena CA 2 nd July 2002	Cardiopulmonary arrest; cocaine intoxication	Heart problems (hypoxic encephalopathy)	3x	Chased by police. Beaten, choked.	Died at Arrowhead Regional Medical Center.
Gordon Randall Jones, Age 37 (W) (AUT)	Orange County FL July 2002	Positional asphyxia secondary to application of restraints in setting of acute cocaine intoxication (first autopsy) 9 Months later officials requested another autopsy-Dr Cyril Wecht conclusion drawn J died primarily from cocaine overdose	Restraints/cocaine intoxication Was carrying half a pill of Maxidone-addictive pain killer	13 x Anderson interviewed by Arizona Republic thinks that taser played role in the death.	Died while strapped face-down to stretcher, agitated during transport	u/k - died on way to hospital Conflicting reports-Dr Salvatore Silvestre-overseer of paramedics- questioned autopsy-said restraints allowed Jones mobility- 'during transport Jones tried to bite, spit and scream at the crew' stopped breathing was turned on back and resuscitated-remained on back and died in ER room.

Name/source indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Stephen L. Edwards, Age 59	Olympia PD, WA 7 th November 2002	Heart attack	Diabetes and obesity	1x ?	Handcuffed	Acc to police not immediate, only after handcuffed they noticed he wasn't breathing Died in hospital
Name Unknown Age 31 (Taser Int)	Albuquerque, NM March 2003		Toxicology screen positive for amphetamines, cocaine, cannabinoids and alcohol.		Pepper Spray/Baton then taser. Broke wires of taser; subdued by multiple officers.	Lost consciousness and died in ambulance.
Terrence Brian Hanna, age 51 (AUT)	Burnaby Mounties, Vancouver BC 21 st April 2003	Acute cocaine intoxication Inquest pending	Cardiac hypertrophy, coronary artery disease. physical		Autopsy states: "... of significance is that patient was placed face down, handcuffed behind his	Reportedly tasered when officers tried to get him out of a police car and went into cardiac arrest at the scene
Joshua Alva Hollander (W) Age 22 (AUT)	San Diego CA May 2003	Anoxic/ischemic encephalopathy Due to cardiac arrest, due to incised wounds of wrists and right hand (manner of death: suicide)	Under influence of methamphetamine Autopsy found he suffered hypoxic brain damage but because of time lapse this did not cause death	2x	Chokehold-carotid restraint- twice tasered after each	Died in hospital-further investigations revealed 30 mins after chokehold and taser use he went into cardiac arrest.

Name/ source indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Timothy Sleet (B), age 44 (AUT)	Springfield, Missouri	Asphyxial death secondary to prone restraint syndrome and phencyclidine	Drug induced agitation. Combative, face- down pressure to chest	Several x	Pepper spray, baton, beanbag Handcuffed behind back with pressure to chest (officer's foot on neck)	Police called to scene where Sleet had just fatally stabbed a woman (his partner) during fight, in front of child. Police used multiple force options before bringing him under control. Soon after subdued, officers noted he was not responding. Pronounced dead at scene after unsuccessful attempts at resuscitation.
Clayton Alvin Willey, (INDIG) Age 33 Canada	Prince George, BC British Columbia RCMP 21 July 2003	Possible cocaine overdose Inquest pending	Pre-existing heart condition		Tasered after handcuffed/hogtied	Tasered when police tried to get him out of police car, collapsed (at scene?), died in hospital 16 hours later
Gordon Rauch Age 38 (source:	Sacramento, CA	u/k		2x		Reported to have gone limp after officers handcuffed him, taken to hospital where died
John Thompson, 45 (source: Taser Int list only)	Zilwaukee, Michigan	Reportedly no significant injuries at preliminary inquest		At least 2x		Reportedly tasered in his apartment, then fought with guards in intake section of jail, put in isolation cell where found dead later the same night

Name/ source - indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Troy Dale Nowell Age 51 (press)	Amarillo PD Amarillo, Texas 4 August 2003	Cardio-pulmonary arrest during violent struggle	Arteriosclerotic hypertensive disease	Several x	u/k Struck on legs with metal baton	Stopped breathing at scene
Walter C. Burks Age 36 (B)	Minneapolis PD Minnesota 7 August 2003	Excited delirium with cocaine use.	Pulmonary heart disease/ emphysema	2x	Pepper spray – prone position, hands cuffed behind back, knees bent.	Dead on arrival in hospital.
Richard Glenn Leyba, Age 37 (W) (AUT) (Paramedic report)	Glendale PD Glendale, Colorado 19 September 2003	Cardiac arrest during cocaine induced agitated delirium necessitating restraint	Pulmonary edema, mild atherosclerosis	At least 5x	Cuffed with both wrists behind back after tasered several x.	Became limp after 3 rd taser. Paramedics noticed he had stopped breathing and was pulseless while being wheeled to ambulance. Attempts at resuscitation were unsuccessful and was pronounced dead on arrival at hospital
Clark Edward Whitehouse, Age 34 Canada	RCMP Whitehorse, Yukon Territories September 2003	Reportedly died of cocaine overdose Inquest pending				Started foaming at mouth shortly after tasered, paramedics at scene unable to resuscitate him; pronounced dead on arrival at hospital.
Ray Austin, Age 25 (Press)	Gwinnet County Jail Gwinnet County, Georgia 24 September 2003	Heart attack, cause not clearly determined by autopsy	History of mental illness	6x	Restraint chair, psychotropic drugs	After being tasered, was strapped in chair and injected with Haldol whereupon lost consciousness. Pronounced dead in hospital half an hr after tasered.
Roman Gallius Pierson Age 40	La Brea PD Yorba Linda, California 7 October 2003	Cardiac arrest due to acute methamphetamine intoxication	History of coronary artery disease	2x	Handcuffed, possibly prone	According to press reports, after 2 nd taser he was handcuffed and “after about a minute” police noticed he was not breathing.

Name/ source - indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Louis Morris, Age 50 (B) (AUT)	Orange County Sheriffs Dept Florida 21 October 2003	Cocaine excited delirium	Atherosclerotic coronary artery disease	1x	Autopsy notes "sudden arrest after being restrained with handcuffs and ankle restraints (hobbled)"	According to press article died "just minutes after Orange County sheriffs deputies used a Taser stun gun on him" (Autopsy noted police reports that he was still agitated and talking after shocked with taser)
Dennis Hammond Age 31 (W) (AUT)	Oklahoma City Oklahoma October 2003	Acute methamphetamine intoxication	Blunt force head injury; multiple injuries to abdomen, thighs and back; multiple abrasions and superficial cuts.	5x	3 beanbag rounds/handcuffs	EMSA bandaging his incised wounds to both calves and soles of feet when he "turned blue and stopped breathing". Reported to have been several minutes after he was restrained. Died at hospital.
Michael Sharp Johnson Age 32 (B) (AUT)	Oklahoma City Oklahoma November 2003	Acute congestive heart failure due to cocaine induced cardiac arrest, drug abuse, agitated delirium, physical exertion.	Drugs abuse, agitated delirium, physical exertion and restraint.	5x	Handcuffs and leg restraints - after being tasered took 3 officers to help gain control	During brief struggle he was tasered multiple times before police were able to handcuff him. Approx 2 mins later he stopped breathing at scene, placed on a ventilator admitted to intensive care with multi-system failure. Died approx 22 hrs later.
Kerry Kevin O'Brien, (W) Age 31 (AUT)	Pembroke Pines Florida 10 th November 2003	Positional asphyxia due to hogtying and prone restraint.	Excited delirium a factor. NB no alcohol, narcotics or other recreational drugs found in system. (History of asthma, depression).	4x	Hogtied, face-down (prone), head pressed down, officers' weight on shoulders, legs, buttocks.	Stopped breathing and no pulse at scene after restraint. (autopsy notes he continued to struggle after being tasered)
James L. Borden, Age 47 (B) (AUT)	Monroe Indiana November 2003	Cardiac dysthythmia secondary to hypertropic cardiomyopathy (heart attack), drug intoxication and electrical shock	Pre-existing heart condition Was confused and weak on arrest; may not have taken his diabetes medication.	At least 6x Taser found to have played role in death		Lost consciousness after last electro shock in jail booking area. Pronounced dead in hospital. Officer charged and awaiting trial.

Name/ source - indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Lewis Shanks King, Age 39 (B) (AUT)	St Johns Florida 9 December 2003	Cardiac arrest during prone restraint due to hypertrophic and ischemic cardiomyopathy	Heart disease, stress and physical exertion during arrest	At least 2x	Handcuffs and ankle restraints prone position	Taser applied before put in restraints, still struggling after restrained, died on way to hospital
Curtis Lawson Age 40	Unadilla Georgia 10 December 2003	Cocaine overdose		2x	Pepper spray (other unknown)	Police say continued to fight after being shocked; after about 15 minutes while waiting for transportation suddenly ceased breathing at scene
David Glowzenski Aged 35	Southampton Village Police NY 4 February 2004	Autopsy results pending	History of mental illness	9 x	Beaten and hit with pepper spray	
Raymond L. Siegler, Age 40	Minneapolis PD Minneapolis 12 February 2004		Press reports say pre-existing medical conditions		u/k	u/k, suffered cardiac arrest shortly after shocked. Died 6 days later.
William Lomax, Age 26 (transcript of coroner's inquest)	Las Vegas Nevada 21 February 2004	ME found COD cardiac arrest during restraining procedures (including taser, exertion from drugs and physical struggle, and fact he was on stomach, further restricting breathing). Coroner's inquest returned verdict of COD to be "combination of drugs, restraining force and use of taser"	Early stages of pneumonia along with PCP (though PCP not an an extremely toxic level). Overweight.	7x in the course of nine minutes, including at least 3x on neck (some jolts lasting 8 and 6 seconds)	Handcuffed and placed face down on a stretcher Inquest jury ruled that jolts from Taser played a role in death. ME testified that his COD findings on restraint included taser as a factor, though could not be sure death would not have occurred without taser.	Noticed to have stopped breathing at scene, after placed on stretcher. Died a day later in hospital.

Name/ source - indicated if autopsy (AUT)	Police agency/ City/ State Month/Year of death	Cause of death	Contributory factors/ Underlying health condition	Number of Taser activations; possible Taser link in autopsy report	Other Restraint	Time between taser use and death or cardiac arrest/loss of consciousness.
Curtis Rosentangle Age 44	Silverdale Washington 21 February 2004		Signs of "substance induced psychosis"			"stabilized", taken to hospital where died "some time later"
Perry Ronald Age 28 (Taser Int)	Edmonton, Alberta Canada March 2004		Jumped from third floor and shattered ankle	Hit several times in drive stun mode	Hobble restraint	Went into cardiac arrest about an hour after being restrained. Died in hospital without regaining consciousness.
Terry L. Williams Age 45	Madison Illinois 30 March 2004	Coroner's jury determined COD was an accident caused by "sudden death associated by marked agitation and physical restraint"	Blood alcohol level three times the legal driving limit.	Police will be looking at how many times taser fired (has data bank)	Was found asleep. Was handcuffed on one arm and as he awoke he dropped to the ground this was when he was tasered.	Police said he was "conscious and alert" when they left his home-not certain how much time elapsed between firing of taser and W becoming unresponsive. Press report stated halfway through the four block journey to the police station W stopped talking and lay down in the seat. At the station he wouldn't get out of the car then officers noticed he was unresponsive.
Melvin Samuel Age 38	Houston County Jail Georgia 16 April 2004	GBI ME found no obvious cause of death.		3x	Two belly chains/set of leg irons when placed face down in holding cell	Taser used to subdue him shortly after 1am, about 10mins after struggle, deputies noticed he wasn't breathing.
Alfredo Diaz Age 29 (Latino)	Orange County, Florida 18 th April 2004	Autopsy pending	Possible drug ingestion.	At least 2x	Pepper spray/ handcuffed	They noticed he was having trouble breathing after second dart and handcuffed, called an ambulance (i.e. lost consciousness at the scene)

Canada

Excessive and lethal force? Amnesty International's concerns about deaths and ill-treatment involving police use of tasers

Introduction and summary

Within the last few years, at least nine people in Canada – and over 60 in the US – have died after being shocked with a taser: a hand-held stun gun which fires two barbed darts at a distance, causing instant incapacitation to the target by delivering a 50,000 volt electro-shock. The weapons can also be applied close-up as stun guns. All but two of the nine who died were unarmed.

As the taser has become a more widespread and established weapon in law enforcement officers' non-lethal arsenal¹, Amnesty International has received numerous reports that the taser is being used not only in situations which do not warrant such an extreme level of force but as a routine force option to subdue non-compliant or disturbed individuals who do not present a danger to themselves or others. In some of the cases reported, Canadian police subjected individuals to multiple force options, deploying the taser in combination with pepper spray and/or dangerous restraint holds.

Agencies deploying tasers claim they reduce injuries and save lives by providing officers with an alternative to using their firearms or batons. However, Amnesty International's research shows that, in both the USA and Canada, tasers are being used in situations where police use of lethal force – or even batons – would never be justified.

Amnesty International considers that electro-shock weapons are inherently open to abuse by unscrupulous law enforcement officials as they are portable and easy to deploy; can deliver multiple shocks at the push of a button and inflict severe pain without leaving significant marks on the skin.

The organization believes that the level of police force in the reported incidents contravenes international standards prohibiting torture or other cruel, inhuman or degrading treatment as well as standards set out under the United Nations (UN) Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials. These require that force should be used as a last resort and that officers must apply only the minimum amount of force necessary to obtain a lawful objective.

¹ According to Taser International, the RCMP has approximately 1700 Taser M26 models in active service (Taser International, www.taser.com). Media reports indicate that more than 60 law enforcement agencies in Canada have been issued with tasers.

They also provide that all use of force must be proportionate to the threat posed as well as designed to avoid unwarranted pain or injury.

International standards encourage the development of non-lethal incapacitating weapons for law enforcement “for use in appropriate situations, with a view to increasingly restraining the application of means capable of causing death or injury to persons”, but state that such weapons must be “carefully evaluated” and their use “carefully controlled”. Amnesty International does not believe such safeguards have been met in regard to taser use, despite their growing deployment by forces across Canada and the USA.

Amnesty International reiterates its call on law enforcement agencies to suspend all use of electro-shock weapons, pending an urgent rigorous independent and impartial inquiry into their use and effects. Other recommendations given at the end of this report include recommendations for the immediate control and limitation on the use of the taser by forces who continue to deploy such weapons.

This report is being published in conjunction with another on the USA which sets out in greater detail Amnesty International’s concerns regarding police use of the taser, and includes details of taser-related deaths and the misuse of tasers by law enforcement officers in the USA, as well as a review of safety concerns relating to electro-shock weapons.

Recent Developments

As a result of recent taser-related deaths in Canada, the Canadian Association of Police Chiefs has launched a review into police use of the taser. On 10 August, the association announced that they had commissioned “a unique and comprehensive review of scientific research, field reports, and data on the use of Tasers in police work in Canada and around the world”. The review will be conducted by the Canadian Police Research Centre, a partnership of the Chiefs Association, the Royal Canadian Mounted Police (RCMP) and the National Research Council.

On 5 August 2004, British Columbia’s (BC) Police Complaints Commissioner, Dirk Ryneveld, called for an inquiry to investigate emerging concerns regarding the possible lethality of tasers when used by the police. In naming Chief Constable Paul Battershill of Victoria Police as Chief External Investigator, he ordered a review of the use of the taser by BC police departments and specifically its use in connection with the in-custody death of Robert Bagnall.² The commissioner highlighted in particular the growing concern over recent deaths involving individuals frequently in situations where the subject was suspected to be under the influence of drugs.

The Commissioner asked Battershill to review BC’s present use of force policies and to provide interim recommendations as he deemed appropriate for the use of the Taser by police officers in the province. Although the Commissioner believes “the use of the Taser may have saved lives...there may also be a category of individuals, those on drugs, whose adrenaline is already pumping, that just can’t take 50,000 volts of electricity”.

² See page 8

The interim report, published in September, does not cover the investigation into Robert Bagnall's death – which is still ongoing – but relates to police use of the taser in BC, including interim recommendations relating to police Taser training, reporting and terminology.

The conclusions and recommendations of the report are based on data collected by three sources: the Victoria police between 1999 and July 2004, the Edmonton Police Service between 2001 and July 2004, and Taser International. Based on an analysis of this data, and a review of published medical studies – a number of which were sponsored by Taser International – the report concludes that “appropriate use of the Taser presents an acceptable level of risk to subjects being controlled” and should as such be retained as an intermediate weapon for use by police within British Columbia. The report highlights a need for greater levels of accountability and a more uniform province-wide training program in the safe use of the weapon. It also calls for better training on the use of restraints – whether or not an individual has been tasered – in order to decrease the risk to certain groups who are most in danger from sudden and unexpected death associated to restraint.

The specific interim recommendations include: a standardized training course on the safe use of the taser provided to all officers using the weapon; a mandatory reporting policy for all taser deployments allowing for province-wide analysis of taser use; for new acquisitions of the weapon, the report recommends the X26 Taser due to its data collection capabilities and lower electrical output; the provision of a standardized ‘Excited Delirium’³ training course to all officers in the province; and finally, the suspension of the use of the ‘hogtie’⁴ restraint held by all officers in the province, and in its place, the use of a ‘Hobble’ or a ‘Wrap’ restraint or other similar devices. Amnesty International has expressed concern that the ‘Hobble’ restraint (a modified form of hogtie) is itself a potentially dangerous form of restraint which has been associated with deaths in custody in the USA and has therefore called for a ban on this procedure as well.

The British Columbia's Coroner's Service will be reviewing the deaths of the four individuals who died in the province after police deployed a taser against them. These reviews will be carried out in separate Coroner's inquests and will involve in-depth consideration of the evidence and circumstance of each case. This is a standard procedure for all in-custody

³ A condition known as “excited delirium”, sometimes also referred to as “in-custody death syndrome”, has been attributed by some US and Canadian coroners to a number of deaths in custody, especially in the case of persons on drugs or suffering from psychosis. It is a combination of signs and symptoms, including dangerously elevated body temperature levels, leading to sudden death. The theory relating to such a syndrome is controversial and disputed by some medical experts.

⁴ Traditional “hogtying” involves the individual's wrists and ankles being bound together, so that the shoulders and ankles are raised, placing pressure on the abdomen, a particularly dangerous procedure. The hobble restraint may have a longer cord between the wrist and ankles, allowing somewhat more movement, mainly to allow the individual to be transported in an upright position; while this is less dangerous, deaths have been reported from the hobble restraint, even where someone is placed on their side or upright.

deaths in BC. The Coroner's service is also conducting a wider investigation into deaths in the province involving police restraint since 1994, which will include these four cases.

The Canada Safety Council (CAC) while maintaining that tasers are "the best alternative to firearms" has called for a comprehensive review on when Taser guns should be used. According to CAC president, Emile Therien, guidelines for the use of tasers "must balance medical concerns with personal safety of police officers, suspects and bystanders." In quoting a 1989 study which disclosed a connection between the use of stun weapons and the occurrence of heart attacks in pigs with pacemakers, Therien added, "Tasers used in some less threatening situations such as crowd control raises concerns. Even a relatively small shock can cause cardiac arrest in someone with a weak heart."⁵

Deaths in custody

Within the last fifteen months, nine people have died after being shocked with a taser by law enforcement officials in Canada. More than 60 people have died in the USA after being hit with police tasers in the past three years. While coroners have usually attributed the deaths to other factors, such as drug intoxication, some medical professionals believe taser shocks may exacerbate a risk of heart failure in cases where people are agitated or under the influence of drugs, or have underlying health problems. Furthermore, in at least five recent US cases, coroners have found the taser directly contributed to the deaths, along with other factors such as drug intoxication and heart disease.

The rising death toll heightens Amnesty International's concerns about the potential health risks involved in taser use. While the manufacturers claim the electrical output of tasers is far below the threshold that would trigger cardiac ventricular fibrillation (severe disturbance of the heart rhythm), there remains a lack of rigorous, independent research into the medical effects of such weapons.

While there is a limited amount of literature describing the clinical experience of earlier tasers, there has been virtually no independent, medical literature published to date on the effects of the more powerful M26 or X26 tasers currently deployed in the USA and Canada. The only medical studies prior to the marketing of these new generation taser models were tests on animals commissioned by the company; none of these studies has been peer reviewed by independent medical experts. Meanwhile, a number of medical experts have continued to raise concern that tasers may have adverse effects on certain vulnerable groups, including those under the influence of certain recreational drugs – often the very people who have come into contact with police tasers. Further information on health concerns relating to tasers, and studies or reports conducted to date, is contained in Amnesty International's report on police taser use in the USA, published in conjunction with this report.⁶

Amnesty International is further concerned that many of the nine men who died in Canada were subjected to high levels of force, including other restraint procedures in addition

⁵ Scott Stephenson, *City police still using Taser*, The Observer, www.theobserver.ca, 7 August 2004.

⁶ USA: Excessive and lethal force? Amnesty International's concerns about deaths and ill-treatment involving police use of tasers (AMR 51/139/2004).

to the electro-shocks. These procedures include hogtying, chest compressions and pepper spray, all of which can dangerously restrict breathing especially when combined with other force. While autopsies are still pending in some cases, Amnesty International is concerned that these restraints may also have been a contributory factor in some deaths.

In six of the nine cases reviewed, the deceased appear to have been coerced into restraint positions which have been associated with deaths in custody from "positional asphyxia". Such positions include being held face-down on the ground with weight or pressure applied to the chest. Individuals who are obese, have underlying heart disease and/or who are severely agitated or intoxicated from drugs or alcohol are believed to be at increased risk from such procedures.

In at least five cases, the deceased were placed in a "hogtie" or "hobble restraint", with their wrists or elbows bound behind them to their shackled ankles. This form of restraint is believed to be a particularly dangerous and potentially life threatening procedure, especially if the subject is in a prone position.⁷ Standard-setting bodies discourage the use of hogtying and urge that law enforcement officers avoid holding anyone in restraints, even handcuffs, in a face-down position.⁸ While some US departments have banned hogtying Amnesty International is disturbed that police departments in Canada still authorize such procedures.

Several of the deceased were pepper sprayed before being tasered. Pepper spray, which acts on the mucus membranes and respiratory system, can further restrict breathing and has been associated with in-custody deaths in the USA and Canada. Amnesty International is concerned that use of multiple restraint techniques, including pepper spray, might increase the risk of respiratory failure.⁹ In two cases (see below), an unarmed suspect died after being pepper-sprayed, electro-shocked and restrained.

Positional asphyxia was listed as a direct cause of death in one of the cases examined, and use of restraints was noted as a contributory factor in another. In other cases, however, restraint was not listed as a causal or contributory factor even though death or loss of consciousness appears to have occurred very shortly after the use of restraints.

Experts have noted that multiple factors may play a role in deaths where restraints have been applied, particularly if other risk factors are involved. Amnesty International believes that all the cases require further evaluation. They also underscore the need for clear protocols

⁷ See footnote 3.

⁸ These include U.S. Department of Justice National Institute of Justice (NIJ) Advisory Guidelines for the Care of Subdued Subjects (June 1995); NIJ Bulletin on Positional Restraint, October 1995; Metropolitan Police Complaints Authority (UK), bulletin July 2001.

⁹ Since the early 1990s more than 100 people in the USA are reported to have died after being subjected to pepper spray. While most deaths have been attributed by coroners to other causes, such as drug intoxication or positional asphyxia, there is concern that pepper spray could be a contributory factor in some cases. Pepper spray has been found to be a factor in several recent in-custody deaths. Studies discounting a link between physical restraint and pepper spray have generally been conducted on healthy subjects and do not replicate what happens in the field. Further research is needed.

and training for law enforcement officers on use of restraints and how to avoid excessive or dangerous force when dealing with people with mental health problems and/or acute behavioural disturbance.

- **British Columbia:** On 19 April 2003, Terry Hanna, aged 51, died shortly after he was shot with a Taser by Burnaby RCMP officers.

According to reports, Terry Hanna was seen carrying a hammer and knife as he entered the rear of the North Burnaby Inn. Officers are reported to have shocked Hanna with the taser as he resisted arrest. According to the autopsy report Hanna was then placed face-down on the ground, handcuffed behind his back and hogtied. He is reported to have gone into cardiac arrest and died at the scene after paramedics failed to revive him.

Cause of death was attributed principally to acute cocaine intoxication, cardiac hypertrophy, coronary artery disease and physical restraint contributory factors. Significantly, the coroner noted that “the patient was placed face-down, handcuffed behind his back and “hogtied” during the restraint process”¹⁰

The RCMP Headquarters’ serious crimes section is investigating the death.

- **British Columbia:** Clayton Alvin Willey, 33, an indigenous man from Prince George died on 22 July 2003 after RCMP officers shot him with a taser.

The incident is reported to have occurred after the officers responded to a call from residents that a man was acting irrationally and aggressively. It is reported that the taser was deployed twice against Willey who was handcuffed at the time. Officers are also reported to have hogtied Willey. He died in hospital approximately 16 hours later, after, according to his family, having suffered seven cardiac arrests.

An internal investigation by the RCMP cleared the officers of any wrongdoing. In October 2004, a coroner’s inquest was held into the death; at the time of writing, the conclusion is still pending.

- **Yukon Territories:** In September 2003, Clark Whitehouse, aged 34, died after he was shocked with a taser by Whitehorse RCMP officers.

Clark Whitehouse is alleged to have fled from officers after he was pulled over in his truck for a routine traffic stop. Officers are reported to have witnessed him ingesting a substance as he ran. Whitehouse was allegedly shocked with a taser by the officers as he became combative. According to the officers, Whitehouse began foaming at the mouth at the scene, paramedics were unable to resuscitate him and he was pronounced dead on arrival in hospital.

¹⁰ Autopsy report on Terry Hanna

Toxicology reports indicate that Whitehouse had very high levels of cocaine in his system. An inquest into the death has not yet been held.

- **Alberta:** On March 23 2004, Perry Ronald died after being shot with a taser by officers from Edmonton Police Department. An autopsy failed to determine a cause of death.

According to reports, Perry Ronald became involved in an altercation after being thrown out of a party. Two Edmonton police officers responded to the incident and in the course of the arrest stunned him with the taser an undisclosed a number of times. The officers also placed Ronald in a hobble restraint. He died in hospital after failing to be revived following cardiac arrest.

- **British Columbia:** On 1 May 2004, Vancouver police shot 25-year-old Roman Andreichikov with a Taser as he lay on the floor in his apartment.

According to reports, Roman Andreichikov had taken drugs and was acting irrationally when his friend who was concerned by his erratic behaviour called for paramedic assistance. Although no crime was in progress, Vancouver police were the first to arrive at the scene. Andreichikov is alleged to have complied with police orders to lie face-down on the floor of his flat. Officers are reported to have shot him in the leg with the taser as he rolled over from his front onto his back. An officer is then alleged to have handcuffed Andreichikov's hands behind his back before pushing his head down against the floor while two others bent his legs at the knees using their body weight to drive his ankles into his back.

According to reports, Andreichikov died within minutes after informing officers that he couldn't breathe.

An internal investigation is being carried out into the incident which will be handed over to Crown Counsel for review. The final coroner's report, including toxicology reports is in preparation. According to the Coroner, Andreichikov died of cardiac arrest however, "what caused the cardiac arrest we don't yet know".

- **Ontario:** May 13, 2004, Peter Lamonday, a 33-year-old landscape worker, died approximately twenty minutes after London Police Service (LPS) officers pepper-sprayed him, punched him in the face, and then tasered him a number of times.

Reports of the incident state that Lamonday had been acting strangely and was breaking doors and windows of businesses along Hamilton Rd., London. An altercation ensued when police confronted him in a parking lot; officers are alleged to have pepper-sprayed him and then punched him in the face. In the course of attempting to handcuff Lamonday, an officer is alleged to have shocked him a number of times with a taser in stun gun mode. Seven officers are then reported to have used their combined body weight to pin Lamonday to the ground before handcuffing him and using a flexible restraint to secure his feet together. He is

reported to have been placed on a restraint stretcher and died minutes after he arrived at hospital.

A post mortem examination concluded that Lamondy died from "cocaine-induced excited delirium". The incident was investigated by Ontario's Special Investigation Unit (SIU), a civilian agency that probes all serious incidents of injury or death involving the police. The SIU concluded that there are "no grounds to believe that any LPS officers are criminally responsible in relation to the death of Peter Lamondy".

- **British Columbia:** 23 June 2004, Robert Bagnall, aged 54, died shortly after being shocked with a taser by Vancouver police officers.

According to reports, police were called to a hotel where Robert Bagnall had locked himself in the bathroom and was allegedly destroying hotel property. In the course of the arrest, police are reported to have shocked Bagnall with the taser. He died at the scene despite paramedics' attempts to revive him.

According to subsequent information provided by the police, the officers made the decision to use the Taser when the fire alarm in the building went off and the hotel began filling with smoke.

Preliminary toxicology reports indicate that Bagnell had a high level of cocaine in his blood. The case is under investigation by Major Crimes Unit and a full pathology report will be carried out. Vancouver police delayed disclosing that Bagnell had been shot with a taser for a month. According to the British Columbia's Police Complaints Commissioner, Dirk Ryneveld, the Vancouver Police Department's (VPD) delays in disclosing information created "an adverse perception of the ability of the VPD to conduct an impartial investigation" and sparked the need for the incident to be investigated by an external force.

- **Ontario:** 17 July 2004, Jerry Knight, a semi-professional, 29-year-old boxer, was pronounced dead on arrival at hospital after being subdued with a taser by officers from Peel Region Police Department.

According to reports, police were called to a motel following reports that a guest had become violent and was throwing objects around the reception. Police attempted to subdue Knight, including using pepper spray, before shooting him with a taser in stun drive mode. Police are then reported to have hogtied Knight; securing his handcuffed hands and ankles together. He is reported to have lost consciousness at the scene and died shortly thereafter in hospital.

A post mortem examination established that Knight died from "restraint asphyxia with cocaine related excited delirium". According to James Cornish, Interim Director of the SIU, "the actions of the police appear to have played a role in Mr Knight's death, their actions in and of themselves cannot be said to be criminal, at least based on the available evidence." The taser has been ruled out as a contributing cause of death.

An inquest into Knight's death, which will be looking at all forms of less-lethal force, including the taser, will be carried out now that the SIU investigation has been completed.

- **Ontario:** 8 August 2004, Samuel Truscott, 43, died after he was pepper-sprayed and shocked with a taser by Kingston police officers.

According to reports, police were called to Truscott's home where he had reportedly overdosed on drugs and had barricaded himself in a room. Armed with a baseball bat and knife, he was threatening to hurt himself. Officers are reported to have pepper-sprayed Truscott before deploying the taser against him. Truscott is reported to have walked unaided to the patrol car but died approximately two hours later in hospital following cardiac arrest.

According to the preliminary autopsy, cause of death was attributed to drug overdose. Following the findings, which reportedly exonerated police involvement – and the role of the taser – in Truscott's death, the provincial SIU closed its investigation into the incident.

Taser incidents involving excessive use of force and ill-treatment

Amnesty International has received disturbing reports of inappropriate and abusive use of tasers in Canada. Reports show that tasers are commonly used to secure compliance in routine arrest and non-life threatening situations, including use against persons not actively resisting arrest, and against non-violent protesters. In some of the cases, the treatment by police officers is in clear violation of international standards prohibiting torture and cruel, inhuman and degrading treatment – including the International Covenant on Civil and Political Rights which entered into force in Canada in 1976 and the Convention against Torture, ratified by Canada in 1987 – as well as international guidelines on police use of force.

In a number of the cases examined, officers used tasers in stun gun mode. Tasers in stun gun mode are particularly easy to use and abuse because there is no need to load or reload a cartridge. As they are applied through touch stunning the subject's skin or clothing, they tend to be used against individuals who are already in custody or under police control in some way.

In more than half the cases, individuals were subjected to multiple taser discharges. Amnesty International believes that questions remain about the harm caused by subjecting someone already in an agitated state to multiple electro-shocks, especially in conjunction with other force.

- **British Columbia:** In February 2004, an RCMP officer was charged with assault for stunning a distraught man, Robert Thomas, aged 30, seven times with a Taser in August 2001, including on the face, kidney area, arms and hand causing "excruciating pain".

Thomas's girlfriend had called the police to report that Thomas had swallowed a large quantity of anti-depressants. Thomas, who was reportedly frail and suicidal and not violent, was shocked with the gun after he climbed down from a tree which was surrounded by police.

The officer was found not guilty on the charge of excessive force despite three fellow officers testifying that Thompson was under control when he was tasered. However, the trial judge criticized the officer for using the taser twice on an already stressed individual and stated that the use of the taser had not been necessary considering that the three other officers had Thompson on the ground and under relative control. The judge is reported to have noted inconsistencies in taser-related police training and called on forces to resolve this.

A formal hearing has been scheduled by the RCMP to determine whether the actions of the officer concerned contravened policy guidelines. The officer remains suspended with pay pending resolution of a second charge of assault in another case involving potential misuse of a taser.

- **Ontario:** In February 2004, the RCMP Public Complaints Commission (an independent watchdog agency) issued its final report into policing at the 2001 Summit of the Americas in Quebec City. It found that excessive force was used by the RCMP in dealing with the largely peaceful demonstrators.

The Commission chairwoman found that the RCMP tactical squad's use of an M26 Taser against a protester who was lying face-down on the pavement, waiting to be arrested, with one arm held up for a handcuff and the other over his head flashing the peace sign, was a clear abuse of authority. The man was "not struggling and represented no threat to the members, to himself, to the public or to property". The Chair reiterated her recommendation that the incident be fully investigated by the RCMP and saw "no plausible reason, given the nature of this complaint...that this has not yet been done". The Commissioner stated that the RCMP was wrong not to have thoroughly investigated the incident and urged it to do so immediately.

- **Alberta:** On 30 July 2002, an Edmonton police officer is reported to have used a taser to subdue a handcuffed woman and was charged with 'assault with a weapon' in July 2004. A second Edmonton officer was charged the following month with two counts of 'assault with a weapon' arising from an alleged misuse of a taser gun in an incident in November 2003.

- **Alberta:** On 5 October, 2002, a 17-year-old indigenous youth was allegedly assaulted by an Edmonton Police Service officer while several other officers looked on.

According to reports, police responded to a noise-disturbance incident involving a group of youths who were sitting with the owner's permission in a broken-down car.

Five officers and a police dog are reported to have surrounded the car and pulled all but one of the youths out. The remaining teenager, Randy Fryingpan, was allegedly shocked with a Taser as -- drunk and unconscious -- he failed to respond to police commands to exit the car.

The officer involved admitted in court -- during related proceedings last June -- that he had shot the seventeen year-old seven times with the taser before hitting him in the mouth with the blunt end of the weapon in the course of administering a 'head-stun'.

According to the officer, the youth was resisting arrest. Witnesses claim, however, that this was not the case, but that his body jolted, as a consequence of being shocked with the weapon at close range.

Fryingpan was treated in hospital for burn-marks and concussion before being admitted to Edmonton Young Offenders Centre where he was placed on a fifteen-minute medical watch because of his injuries.

Fryingpan's mother filed a formal complaint against the officer involved in the alleged assault. Then Chief of Police, Bob Wayslyshen, who is the father of the police officer involved, refused to refer the investigation of his son's misconduct to another jurisdiction and a complaint filed against him for this reason has been summarily dismissed. Two-years on, the results of the investigation are not forthcoming.

- **Ontario:** A number of Algerian asylum seekers alleged that Ottawa Police Services tactical squad and members of the RCMP kicked them and jolted them with tasers after breaking up a non-violent protest against a deportation order at a federal immigration minister's office on 29 May 2003.

The protesters had reportedly occupied the minister's office all day without incident, and the alleged ill-treatment occurred when police tried to evacuate them from the building in the evening. A number of people reportedly sustained Taser burns on their neck, back and arms; another was reported to have been hit on the head with the butt of a Taser, while another man's tooth was allegedly broken when he was punched in the face by a police officer.

The twelve men were arrested, charged with "mischief" and released from jail the next day.

Two of the twelve men have since been deported; the trial of the remaining ten began in June 2004 and is scheduled to resume for two weeks in February 2005. The defence has argued that the force used to arrest the accused was excessive and unnecessary and has resulted in physical and emotional trauma for the accused, who were cooperative, unarmed and passive during their arrest.

The non-violent protests against the deportation orders continued outside of the building on 29 May 2003, where a number of demonstrators had gathered. Amnesty International received reports of the following two serious incidents concerning the potentially abusive use of force during the protests:

- **Ontario:** An RCMP officer arrested Paul Smith, a representative of a local non-profit, volunteer organization as he took photos of the demonstration.

According to reports, in the course of removing Smith from the area, an Ottawa police officer twice jolted Smith with a Taser – in stun gun mode - near his groin as he lay handcuffed on the ground. Witnesses report that Smith was neither violent nor combative.

Smith was held in Ottawa Police station for three hours before being released without charge.

Smith filed a formal conduct complaint against the Ottawa Police Service (OPS) in November 2003. The OPS determined in May 2004 that the force used by the officers in requesting and deploying the taser was not excessive in the circumstances and found his complaint to be unsustainable. At Paul Smith's request, the Ontario Civilian Commission on Police Services reviewed his complaint and subsequently directed that a hearing be held into the incident. On 26 October 2004 both officers appeared at the hearing charged with employing excessive force in using a stun gun during the arrest of Paul Smith.

- **Ontario:** Another protester, Heidi Rimke, was allegedly shot on the breast with a taser in stun gun mode by a police officer as she shouted in protest as she witnessed the aforementioned incident.

Rimke filed a complaint of excessive force against the officers with the Ottawa Police Professional Standards office (OPPSO). The OPPSO rejected the complaint and asserted that the use of the Taser had been justified as Rimke had been moving against the officer at the time of the deployment.

However, witnesses to the incident refute this account and report that the officer was approximately four meters away and walking towards Rimke when he shot her with the Taser.

- **British Columbia:** On 28 March 2003, Germain Quesnel, a French-Canadian reportedly suffered a heart attack after being tasered in custody by Richmond RCMP officers.

According to reports, officers arrested the individual at his house for breach of the peace. They failed to inform him why he was being arrested, nor of his rights to contact his lawyer. Officers are alleged to have shocked Quesnel - who was handcuffed at the time - approximately ten times, in stun gun mode, after he refused to get out of the patrol car. Approximately two hours later, after being placed in a cell, and stripped down to just a T shirt, he is reported to have been shocked again in stun gun mode with a taser directly on the chest. Immediately, Germain Quesnel is alleged to have complained about pains in his chest and requested his medication and the attention of a doctor. Despite carrying his medication on his person, the police originally failed to locate it. Approximately three hours after being tasered for the second time, Quesnel was released and taken to hospital where doctors confirmed that he had suffered a heart attack.

According to his doctor, "Although the taser attack did not cause his coronary artery disease it is possible that the Taser attack precipitated an episode of atrial or ventricular fibrillation that

compromised his coronary circulation resulting in his myocardial infarct of March 29 2003. This would not have produced a myocardial infarct if he did not have pre-existing heart disease."

An internal investigation into the incident, concluded in May 2004, found that the officer who had shocked Quesnel in the cell had used excessive force in deploying the taser against him. As far as Amnesty International is aware, the officer has not been disciplined. In a letter from Superintendent Ward Clapham of Richmond RCMP to Germain Quesnel, he is advised that the officer was told "that his conduct was not acceptable" and would be given additional training in the use of the taser. Clapham continues, "He assured me this will not reoccur". Three months later, the same officer, as reported below, was involved in another case involving the misuse of a taser.

- **British Columbia:** On 30 May 2003, Richmond RCMP officers shocked 58-year-old Phillip Spicer as he lay immobilized in the back seat of a patrol car.

According to reports, Phillip Spicer was arrested by officers for failing to agree to leave a pub where he had been drinking. He is reported to have fully cooperated with the officer, but after being handcuffed experienced difficulties – due to his size and the lack of space in the patrol car - getting into the back seat. Officers are alleged to have hit him on the back of the legs, possibly with a night stick, to encourage him to get into the car. During the journey, Phillip Spicer remained on his back, with his hands cuffed behind him, and his knees bent.

According to reports, when officers failed to pull Phillip Spicer out of the car by dragging him by the shoulders - which were too broad for the door opening - an officer is alleged to have jumped onto the front seat, and with no warning, shocked him with a taser seven times on his stomach and thighs resulting in second degree burns. The charges against him were eventually dropped.

The Richmond Detachment of the RCMP is investigating the incident.

CONCLUSIONS AND RECOMMENDATIONS

Tasers are widely promoted as being a useful weapon, safer than many other weapons or techniques used to restrain dangerous, aggressive and focused individuals. In practice, however, they are commonly used to subdue individuals who do not pose a serious and immediate threat to the lives or safety of others. In many reported instances police actions using tasers appear to have breached international standards on the use of force as well as the prohibition against torture or other cruel, inhuman or degrading treatment or punishment.

Amnesty International considers that electro-shock weapons are inherently open to abuse as they can inflict severe pain at the push of a button without leaving substantial marks, and can further be used to inflict repeated shocks. While the capacity for abuse exists in whichever mode tasers are deployed, Amnesty International believes that tasers in "touch"

stun gun mode are particularly open to abuse, as they are designed for “pain compliance” and tend to be used against individuals who are already in custody or under police control, often with multiple shocks.

Amnesty International is further concerned that, despite being widely deployed, there has been no rigorous, independent and impartial study into the use and effects of tasers. Medical opinion has continued to raise concern about potential health risks from tasers, particularly in the case of people suffering from heart disease, or under the influence of certain drugs. Amnesty International’s concerns are heightened by a growing number of deaths of individuals struck by police tasers. The organization believes that the taser cannot be ruled out as a possible contributory factor in some deaths. Concerns about the risks associated with tasers increase as they become more widely deployed.

Many police agencies claim that tasers have the potential to save lives or avoid serious injury in cases where police officers might otherwise resort to firearms or other forms of deadly force. It is self-evident that tasers are less-lethal or injurious than firearms. Amnesty acknowledges that there may be situations where tasers might effectively be used as “stand-off”, defensive weapons as an alternative to firearms in order to save lives. This appears to be the aim of the limited introduction of tasers to UK police who operate under strict rules. However, it appears that in practice tasers are rarely used as an alternative to firearms in Canada and many officers appear to use them at a relatively low level on the “force scale”. Amnesty International further notes that measures such as stricter controls and training on the use of force and firearms are likely to be more effective overall in reducing unnecessary deaths or injuries.

Amnesty International welcomes the announcement in August 2004 by the Canadian Association of Chiefs of Police that they, in conjunction with the Canadian Police Research Centre, the RCMP and the National Research Council, will conduct a review of all taser literature, field reports and other international data with a view to synthesize .

The organisation feels however that this review does not go far enough as it will not involve any new research involving the new generation of tasers - the more powerful M26 or X26 models - that are currently deployed in the Canada, and on which there has been virtually no independent, medical literature published to date. The only medical studies prior to the marketing of these new generation taser models were tests on animals commissioned by the Taser International; none of these studies has been peer reviewed.

Amnesty International urges the CACP, with the support of the federal government, to ensure that the following recommendations are incorporated into their review:

- The inquiry should be carried out by acknowledged medical, scientific, legal and law enforcement experts who are independent of commercial and political interests in promoting such equipment. They should rigorously assess their medical and other effects in terms of international human rights standards regulating the treatment of prisoners and use of force; the inquiry should include the systematic examination of all known cases of deaths and injury involving the use of such weapons and also consider the mental impact

of being subjected to electro-shock. The study should recommend strict rules, safeguards and oversight procedures to prevent misuse of any types of electro-shock equipment that may be viewed as having a legitimate use in law enforcement. A report of the findings of such an inquiry should be made public promptly after completion of the study.

Amnesty International urges all police enforcement agencies to:

- Suspend all transfers and use of tasers and other electro-shock weapons pending the completion of a rigorous, independent and impartial inquiry into their use and effects.
- International standards recognize that situations will arise in which police officers will have to use force. However, these standards, specifically the (UN) Code of Conduct for Law Enforcement Officials and the Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, set specific guidelines on when, how and the extent to which force can legitimately be used. All law enforcement agencies should ensure that officers are trained to use force strictly in accordance with these standards.¹¹
- All police authorities should ensure that use of force training programs for law enforcement officials include international standards on human rights, particularly the prohibition against torture and cruel, inhuman or degrading treatment or punishment.
- All allegations of human rights violations and other police misconduct should be fully and impartially investigated. All officers responsible for abuses should be adequately disciplined and, where appropriate, prosecuted.

Where law enforcement agencies refuse to suspend their use of tasers, pending the outcome of the above-mentioned inquiry, Amnesty International recommends that:

- departments using tasers should strictly limit their use to situations where the alternative would be use of deadly force. Examples would include: armed stand-offs, instances in which a police officer faces a life-threatening attack or injury, or threat of attack with a deadly weapon, or where the target presents an immediate threat of death or serious injury to him/herself or

¹¹ These require *inter alia* that law enforcement officials shall, as far as possible, apply non-violent means before resorting to the use of force and firearms; exercise restraint in such use and act in proportion to the seriousness of the offence and the legitimate objective to be pursued; minimize damage and injury, and respect and preserve human life. Law enforcement officials shall not use firearms except in self-defence or the defence of others against the imminent threat of death or serious injury; in any event, intentional lethal use of firearms may only be made when strictly unavoidable to protect life.

others. In such circumstances, tasers should be used only where less extreme measures are ineffective or without a promise of achieving the intended result.

- Unarmed suspects should not be shot with a taser for arguing, talking back, being discourteous, refusing to obey an order, resisting arrest or fleeing a crime scene, unless they pose an immediate threat of death or serious injury that cannot be controlled through less extreme measure.
- Operational rules and use of force training should include a prohibition against using tasers on the following groups, except as a last resort to avoid deadly force when no alternatives other than firearms are available: pregnant women; the elderly; children; emotionally disturbed persons or people who are mentally or physically disabled; people in vulnerable positions where there is a risk of serious secondary injury (e.g. in dangerously elevated positions, or near flammable substances); people under the influence of drugs.
- Repeated shocks should be avoided unless absolutely necessary to avoid serious injury or death.
- Departments should prohibit the application of prolonged shocks beyond the five-second default charge in any cycle.
- Tasers should only be used in stun gun mode as a back-up to dart-firing tasers and only when no other options are available to an officer and there is an immediate threat of death or serious injury to the officer, the suspect or another person. The stun gun function should never be used to force a person to comply with an order given by an officer where there is no immediate threat to the life or safety of the officer or others.
- Whenever an individual has been shot with a taser, police officers or custody staff should be required to call paramedics or other medical professionals to administer treatment. It is advisable to take tasered subjects to hospital to have the barbs removed and to monitor for other possible adverse effects.
- All agencies should ensure strict reporting by the departments concerned on all use or display of tasers, with regular monitoring and data made public. In particular:
 - Departments should download data recorded by officers' tasers after every incident in which they are used. A summary of this data should be included in all use of force reports.
 - Each display, "sparking" or shock administered by a taser should be reported in use of force reports, as well as whether the taser was used in dart-firing or stun gun mode and the reasons why a taser was used. The number of trigger-pulls and duration of the shock should be reported in each instance. The age, race and gender of each person against whom a taser is deployed should also be reported.

- Prisons and other institutional facilities should install remote monitoring equipment to record taser usage automatically as it occurs.
- Each department should provide a detailed break-down of its taser use in regular, public reports.

Additional recommendations:

- Mentally ill or disturbed individuals should receive appropriate treatment and alternatives to force in line with best practice. Where officers have reason to believe that a disturbed individual may be acting in a violent or threatening manner as a result of mental illness, efforts should be made to involve mental health specialists in dealing with the disturbed person. Policing methods based on force should only be used as a last resort.
- Dangerous restraint holds such as hogtying and use of carotid neckholds or other chokeholds should be banned.
- There should be strict limitations and guidelines on the circumstances in which pepper spray is used, with clear monitoring procedures.

Information Regarding OCSO Study

Orange County Sheriff's Office (OCSO) Use of Force Study presented at SWAT Roundup Nov 29-Dec 1 in Orlando (Fl). Presentation (*TASER® Deployments and Injuries: Analysis of Current and Emerging Trends*) was three hours long and offered three different times during the conference. The research project was based upon a review of all use of force reports (n=1400) from 2001 – 2003. A sample of 400 cases was selected to perform advanced statistical analysis.

FGCU and OCSO collaborated together to accomplish this unfunded research project. Research in these areas in the past has been difficult, as there often exists a degree of mistrust of researchers outside of the law enforcement agency. However, this current project between FGCU and OCSO illustrates what can be accomplished. Orange County Sheriff's Office's commitment to research reflects their professionalism and commitment to excellence. We are encouraged that with their continued support, we will come to a better understanding of TASER and the impact that it has had on current law enforcement practices.

While less lethal weapons are not perfect and can upon occasion create death or injury, they attempt to provide an officer with the ability to regain control of a bad situation. Police officers do not get up in the morning and secretly hope that they will get the opportunity to injure or kill a member of their community. When given additional options to resolve these situations, law enforcement would most certainly prefer to not take a life. Officers are thrust into these fast moving, quickly evolving scenarios and are required to make a decision in seconds that may take appellate courts years to decide.

This research attempts to break down violent law enforcement/citizen confrontations into a series of events, which will allow us to determine the effect of specific less lethal weapons in the final outcomes. We were also able to test the validity of some commonly held assumptions in law enforcement use of force and provide quantitative findings that law enforcement agencies can use to base policy decisions upon. Findings specific to this study are highlighted

Prior research: Use of force by police in 17% of all arrests (Garner & Maxwell, 2002)

Our study: Use of force by police 2% of all arrests

LESS LETHAL WEAPONS INFORMATION

Less Lethal Munitions

80% injury rate
Majority of injuries bruises / abrasions
Injury caused by impact of projectile
2% mortality rate (8 deaths per 373 deployments)

TASER

Effective 77-95%; High level of de-escalation (90%)
OCSO Study: Ineffective 23% (most were misses)

Very low injury rate
Majority of injuries are bruises / abrasion
Injuries caused by falling
.1% mortality rate (1 death per 870 deployments; 74 deaths since 2001)

K9 Teams

Effective almost 100%; High level of de-escalation
30% injury rate
Majority of injuries are punctures / lacerations
Injury caused by dog bite
Very low mortality rate (3 deaths in 100 years of use)

Impact Weapons

Effective about 50%
OCSO Study: Ineffective 11%
High level of escalation
High potential for injuries
Majority of injuries are bruises and blunt trauma

Chemical Agents

Effective 20- 80%
OCSO Study: Ineffective 12%
Very low injury rate
Low mortality rate (63 deaths in 20 years of use)

Defensive Tactics

OCSO Study: Ineffective 29%
Largest number of suspect and officer injuries

Significant Findings

1. 50% reduction in workman's comp reports due to arrest injuries
 2. In one year alone, eighteen (18) suspects were subdued with a TASER where the use of deadly force would have been justified.
 3. Cost of deadly force litigation is identified at \$100,000. This does not include damages. Based on the OCSO study for a single year, TASER as an intervention in deadly force encounters reduced legal costs by \$1.8 million.
 4. 75% reduction in the use of chemical agents. 50% reduction in physical "hands-on" force by officers.
 5. Less lethal weapons (as a group) were ineffective 20% of the time.
 6. TASER ineffectiveness was generally due to misses.
 7. Ineffectiveness rates for TASER varied greatly by division; specialized units (11%) had better success rates than patrol (22%). This is most likely due to the type of assignments specialized units (narcotics) were involved with and an expectation of suspect resistance. TASER was deployed much earlier in the event, reducing the likelihood that suspect would outdistance the 21' range of the weapon.
 8. Civilian perceptions of force (UCF Study of 1200 students) indicate that TASER and pepper spray are more acceptable methods.
 9. Substantial deterrent effect identified. Nine out of ten suspects surrender when faced with the TASER. Street saying "Two guns-don't run"
 10. If the weapon chosen was not effective in neutralizing suspect resistance, the suspect was likely to use a greater amount of force against the officer. TASER had the lowest escalation rate of all less lethals. Baton use had the highest rate 50%.
 11. Once suspect force escalated, it rarely de-escalated without force on the part of the officer. Consequently, proactive measures could reduce violence before it begins.
 12. Most common suspect resistance types

Flight	32%
Verbal threat or aggressive posture	21%
Wrestle	27%
Strikes	13%
-

ADDITIONAL COMMENTS

There appears to be striking similarities between in-custody deaths from TASER, pepper spray, positional restraint (hog-tie) and lateral vascular neck restraint (choke holds). Bizarre, excited behavior, high body temperature, history of chronic drug use, and an extreme physical exertion appear in the majority of these cases. However, the question regarding the relationship between these tools and the cause of death is best left to the medical experts.

The fact remains that without these less lethal weapons, a substantially larger number of law enforcement officer deaths and injuries would have most certainly occurred, creating additional need to use force against criminal suspects. Suspects receive the greatest benefit of less lethal weapons; frequently they are allowed to keep their lives despite their threat or use of deadly force against police officers.

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MADISON POLICE DEPARTMENT

TASER REPORT

SUBMITTED TO CHIEF OF POLICE NOBLE WRAY BY LIEUTENANT VICTOR WAHL

SUMMARY

In the summer of 2003, the Madison Police Department (MPD) first deployed Tasers as part of an experimental pilot program. The Taser program was one component of an effort to expand the non-lethal use-of-force options available to Madison Police officers. The goal of this effort was to provide officers with additional options that would reduce injuries to officers and citizens, and would reduce officers' utilization of deadly force. The Taser program was expanded significantly in early 2004, with a resulting increase in Taser deployments. This report serves as a summary of MPD's Taser program to date. The report's key findings:

- **MPD's deployment of the Taser has reduced injuries to officers and suspects resulting from use-of-force encounters.**
- **MPD's deployment of the Taser has reduced MPD officers' utilization of deadly force.**
- **The Taser has proven to be a safe and effective use-of-force tool.**
- **MPD officers are deploying the Taser in an appropriate manner.**

HISTORY

In early 2000, the use-of-force tools/techniques available to Madison Police were limited to empty-hand techniques (including compliance holds, takedown techniques, and active countermeasures, like punches or kicks), OC spray, the baton, and firearms (officers' individual handguns or the AR-15 patrol rifle). The department recognized several things about those use-of-force options:

- They all relied on either causing pain or causing injury to be effective. Some subjects—whether they be under the influence of alcohol or controlled substances, have mental health issues, or are simply extremely mentally focused—do not respond to pain and are extremely difficult for officers to control with traditional use-of-force tools/techniques.
- They offered officers no way to deliver non-deadly force from a safe distance.

- They were, for the most part, the same use-of-force options that officers in the 1960's (or earlier) had available.

As a result of these recognitions, the department began exploring other use-of-force options. In the summer of 2000, the department implemented a less-lethal projectile program (bean-bag rounds fired from 12 gauge shotguns). Initially, approximately 70 officers were trained in the use of impact projectiles, and shotguns designated as less-lethal weapons were deployed in certain squads and to District Stations. Other impact projectile weapons were also deployed with the Special Events Team. At the time we proposed implementing the less-lethal program, less-lethal technologies were not new, and had (in various forms) been in use across the nation for years. However, we felt that at that time technology had progressed to the point that it was appropriate for the department to move forward (the particular advancement was the development of the "super sock" round, offering a proper balance of effectiveness and safety).

Since the initial deployment of patrol less-lethal projectile weapons, the program has expanded to over 100 trained users and about 40 less-lethal shotguns. The less-lethal projectiles offer one significant advantage over traditional use-of-force tools/techniques: the ability to deliver non-deadly force from a safe distance. However, they do suffer from the same limitation as most other tools/techniques: they rely on causing pain or causing injury to be effective. As stated above, some subjects will not respond to pain, and are no more likely to respond to less-lethal projectiles than to other use-of-force tools/techniques. [Note: as of January 31, 2005, MPD officers have deployed less-lethal projectiles in 9 incidents; 5 of those deployments likely allowed officers to avoid the use of deadly force]

Since the time we began discussing the less-lethal projectile program, several of us on the department had been monitoring other developments in police use-of-force technology. One device I had researched and tracked was the M26 Advanced Taser, manufactured by Taser International. In October of 2002, I attended an M26 Taser Instructor certification course, to gain additional information about the Taser. The Taser, I learned, functions by causing electromuscular disruption (EMD). The electrical wave of the Taser mimics the wave that the human brain uses to communicate with the body; when the Taser wave is inserted into the body, it overrides these electrical impulses, creating a contraction of the body's muscles and preventing the brain from exercising voluntary control over the muscles. The result is incapacitation. My research suggested a number of advantages the Taser offered over traditional use-of-force tools/techniques:

- Because the Taser causes EMD, it does not rely on causing pain or causing injury to be effective. As such, it allows suspects to be controlled in most cases without injury; and it is effective against subjects who are not responsive to pain (subjects who have historically been extremely challenging – and dangerous – for officers to control).
- The Taser allows officers to control suspects from a safe distance (up to 21 feet).
- Traditional use-of-force tools/techniques exhibit a direct relationship between effectiveness and propensity for injury: techniques that are located near the bottom of the use of force continuum (such as escort holds, pain compliance, etc.) are very unlikely to cause injury, but are also very unlikely to be effective in controlling a subject who is non-compliant; techniques located higher on the continuum (baton strikes, active countermeasures, etc.) are more likely to be effective in gaining control of a non-compliant subject, but are also very likely to cause injury. The Taser, however, offers the best of both worlds. The Taser is extraordinarily effective in controlling resistive subjects, while also being extraordinarily safe (causing virtually no injury in the vast majority of cases, and causing no long-term injury or adverse effects).
- The Taser internally records the date and time each time it is deployed, and that data can be downloaded to a computer and reviewed. The data download will show the time and date for each time the Taser is deployed, as well as the duration of each deployment (how long the Taser current is delivered). Each Taser will store data for about 2,000 firings. Also, each air

cartridge has an individual serial number, and also contains about 20-40 AFID's (anti-felon identification). The AFID's are small confetti-like pieces of paper that are fired from the air cartridge when the Taser is deployed. Each AFID is printed with the unique serial number of the air cartridge it was fired from. This offers a higher degree of oversight and accountability than any other use-of-force tool.

- The electrical output of the Taser is well-below established safety standards, and has no long-term effects.
- Agencies that had deployed the Taser saw a decrease in injuries (to both officers and suspects), a reduction in officers' use of more intrusive use-of-force tools/techniques (such as baton strikes) and a reduction in officers' utilization of deadly force.

As a result of this research, in early 2003 Captain Snyder (then a Lieutenant) and I gave a presentation to the Management Team, recommending that the department move forward with deployment of the Taser. Chief Williams and the Management Team endorsed the concept, and the department acquired two M26 Advanced Tasers as a pilot program in mid-2003. Initially, about fifteen members of the Emergency Response Team were trained to use the M26, and were authorized to carry the Tasers with them on patrol. The department's first Taser deployment was on July 18, 2003. From July of 2003 to February of 2004, there were a total of eleven M26 Taser deployments.

In 2003, while we were moving forward with our pilot M26 Taser program, Taser International introduced the X26 Taser. The X26 offered a number of advantages over the M26. The primary advantage of the X26 was its small size; while the M26 is comparable in size to a Glock 17 handgun, the X26 is 60% smaller and lighter (this difference is critical, as officers trained in the M26 found it difficult to fit on their duty belts). Given the many advantages the X26 offered over the M26, we determined that any future MPD Taser purchases would be of the X26.

A presentation on the Taser was made to the Public Safety Review Board in May of 2003, and presentations were made to the Mayor's Capital Improvement Review Committee in both 2003 and 2004. A press conference unveiling the Taser to the public was held, and local media did a number of stories/articles on the Taser.

In January of 2004, the department ordered 31 X26 Tasers (and associated equipment) from Taser International, utilizing Block Grant funds. The equipment arrived in early-March (literally one day before the first user training was scheduled). In March and April of 2004, about 100 MPD sergeants and officers were trained as X26 Taser users. While Taser International recommends a four-hour training course for users, we provided a full eight-hour day of training. The training consisted of a classroom segment, followed by a written test. The remainder of the training consisted of hands-on training with the Tasers, including weapon retention instruction and a practical Taser deployment scenario. Some points of emphasis during the training:

- The preferred mode of control in any police/citizen encounter remains verbal dialog. While the Taser (and a few years earlier, the less lethal projectiles) offer alternatives not previously available, officers still need to attempt to gain control through verbal dialog in all but the most severe circumstances, and should not accelerate the transition from verbal dialog to physical force simply because of the Taser.
- While the Taser is generally an effective tool, in the field it will not always be effective, and officers need to be prepared to rely on other tools/techniques if necessary.
- Officers need to be aware of their environment prior to deploying the Taser (presence of flammables, other hazards, etc.).

- Officers should be aware of the symptoms of Excited Delirium, and seek medical attention/evaluation for those subjects once they are in custody.

Training was provided to operations sergeants, and a selected group of operations-assigned officers (drawing from the pool of officers who had been trained in the use of the less-lethal shotgun).

One additional training session was held in October of 2004, bringing the total number of MPD Taser trained personnel to 113.

The Tasers were deployed to the CCB and District Stations for checkout by Taser trained personnel. Throughout 2004, I was able to expand our Taser inventory somewhat, and the Task Force also purchased three Tasers (from Task Force funds). We currently have 40 X26's deployed as follows:

District	Tasers Deployed
CCB	12
NPD	8
SPD	8
WPD	9
DCNAGTF	3

ANALYSIS OF DEPLOYMENTS

As of January 31, 2005, MPD officers have deployed Tasers (M26 and X26) 92 times, in 83 incidents. In some instances, one suspect/incident was responsible for multiple deployments (for example, a probe shot where the probes missed followed by a drive-stun).

From the beginning of MPD's Taser program, all Taser reports have been routed to me. I have maintained a database of information regarding Taser deployments, and have analyzed a variety of factors related to MPD's Taser deployments:

Success Rate/Failures

Of the 92 Taser deployments, 71 (or 77%) were effective (meaning the weapon functioned and allowed the suspect to be taken into custody). Of the ineffective deployments, the causes were:

Failure Cause	Number	Percentage of Total Deployments
Probes Missed (one or both)	8	9%
Thick/Heavy Clothing	6	7%
Wires Broke During Fall or Handcuffing	3	3%
Drive-Stun Failure	2	2%
Weapon Malfunction	1	1%
Williamson Street Incident	1	1%

Note that in some of the "failure" cases the suspect still complied. For example, in several incidents the suspect did not receive any significant Taser current due to heavy clothing, but still chose to comply with no escalation in force use.

Recall that the Taser can be used in two modes, a probe deployment (an attached air cartridge fires two probes a distance of up to 21 feet), and the drive-stun mode (with the air cartridge removed, the weapon can deliver a contact stun). While the probes will deliver an incapacitating EMD effect (as described above), the drive-stun mode only results in a stun effect (painful stimulus). As a general rule, therefore, the drive-stun is not nearly as effective as a probe deployment. The drive-stun failure category includes incidents where officers delivered drive-stuns and the suspect did not respond. Some other drive-stun instances resulted in different responses and varying degrees of effectiveness, so quantifying these deployments was somewhat subjective.

A Taser malfunctioned during one field deployment. CPT officers were struggling with a subject, and an officer attempting to deliver a drive-stun to the subject noted that the Taser was not functioning (no spark at all). The subject was controlled after the Taser malfunction, and no injuries resulted.

Williamson Street Incident – On June 14, 2004, David Lopez, having just engaged in a violent confrontation, physically attached MPD Officer Deanna Reilly, stole an MPD squad (crashing it a short distance away), then physically attacked and attempted to disarm MPD Sergeant Karen Krahn, causing her to use deadly force (Lopez survived). A Taser was deployed early in the incident, but Lopez was not incapacitated. The failure of the Taser to incapacitate Lopez generated almost as much media attention as the officer-involved shooting did. To understand what I believe happened with the Lopez Taser deployment, two facts about the Taser must be recalled. First, as a general rule, a wider probe spread will lead to a more effective Taser deployment. Probe spreads of a few inches or less will generally result in a painful effect to the suspect, but not a full EMD incapacitating effect. The second issue to recall is that the Taser works by causing involuntary contraction of muscle tissue. As such, if the probes impact an area on the body that has a low volume of muscle mass, the Taser will be less effective.

As Lopez initially assaulted Officer Reilly, he was in very close proximity to her (a few feet away). Officer Reilly recalled seeing the laser aim point from her Taser on Lopez's upper sternum just prior to deployment. Officer Reilly stated that Lopez tensed up somewhat and screamed as a result of the Taser deployment, a reaction consistent with a close probe spread in an area of low muscle mass. Lopez turned and, in a rigid manner, walked a few steps away from Officer Reilly. From Officer Reilly's description, it is clear that Lopez was feeling an effect—albeit a limited one—from the Taser. However, Lopez was suddenly able to turn and resume his aggression towards Officer Reilly. It is not clear what allowed Lopez to regain full control of his body, but the most likely possibility is that one of the probes came loose. Testing of the Taser after the incident showed it to function properly. After the shooting, Lopez continued to resist and several drive-stuns were delivered to him. These were described as having some effect on Lopez.

While this incident was widely cited as a Taser “failure,” it appears to have simply reflected two known limitations of the Taser (close probe spreads and low muscle mass hits). Also, Lopez's ability to resist on that evening was extraordinary; after crashing a squad car into a tree at high speed and being shot four times, he continued to resist violently.

Deadly Force Avoided

A review of MPD Taser deployments shows that in six cases it can fairly be said that the Taser deployment allowed officers to avoid having to utilize deadly force. Examples:

- An armed robbery suspect fled on foot from officers, then was surrounded but refused to surrender. The suspect indicated that he had a weapon, and reached into his waistband as if he was attempting to draw the weapon. The Taser was deployed and the suspect was taken into custody without injury to officers or the suspect. After the incident, the suspect told the officers he was trying to force them to shoot him and thanked them for not doing so.
- A suicidal subject sat on the edge of his bed, armed with a large butcher knife. He repeatedly told the officers that he was going to charge them with the knife and force them to shoot him. The Taser was deployed and the suspect was taken into custody without injury to officers or the suspect.
- Officers knocked on an apartment door, attempting to contact a sexual assault suspect. The suspect opened the door with a small knife in his hand. The suspect refused to drop the knife, and began to raise it to the officers. The Taser was deployed, and the suspect was taken into custody without injury to officers or the suspect.
- A suicidal subject in a hotel room armed himself with a box cutter. The subject refused to comply with officers, telling them, “you’re going to have to kill me.” The individual had

inflicted cuts to both of his wrists, and was bleeding as a result. The Taser was deployed, and the suspect was taken into custody without injury to the officers or further injury to the suspect.

Also, several of the instances in which Taser use was threatened or the Taser was displayed (but not deployed) involved armed subjects. Those incidents easily could have rapidly escalated to deadly force encounters without the presence of the Taser.

Other Notable Deployments

The first MPD Taser deployment, on July 18, 2003, demonstrated the benefits of the device. A subject needing to be taken into custody for a mental health commitment had barricaded himself in an East Side hotel room. The individual was extremely large (6'5", 265 pounds), and had a history of resisting officers. In fact, during a previous incident where officers had confronted the individual, it took 10 officers almost 10 minutes to subdue him (OC spray and baton strikes were both used with no effect). The individual and several officers sustained minor injuries during that encounter. The officers attempting to extract this subject from his hotel room were aware of this, and requested that I respond with a Taser (at that time I was the only one on MPD trained to use the Taser). After lengthy efforts to get the individual to exit voluntarily were not successful, we entered the room. The subject was in the small bathroom, crouching on the toilet, completely nude. He was shouting incoherently, and had flooded the bathtub, making the tile floor wet and slippery. I deployed the Taser, and the individual was taken into custody in a matter of seconds, with no injuries to the subject or officers. Had officers been forced to take him into custody with traditional police use-of-force tools/techniques, there can be little question that a high degree of force would have been required, and that injuries would have resulted.

Other Taser deployments have demonstrated the great benefit provided by the Taser. Examples:

- At about 2 a.m. on a weekend, officers responded to the 500 block of State Street for a large fight involving more than 100 subjects. The first officer who arrived noted that the disturbance was being instigated by a large individual (6'4", 235 pounds), who was actively fighting with two individuals. Numerous bystanders were hostile to the officers, and some physically attempted to prevent them from intervening. An officer deployed the Taser, which incapacitated the subject, allowing him to be taken into custody without injury. The Taser deployment also caused the rest of crowd to back away and cease their aggressive behavior. This incident would undoubtedly have required the use of much more intrusive use-of-force tools/techniques without the Taser, and injuries would likely have resulted.
- An officer responded to a two-car accident on the City's east side. The officer observed that two subjects from one of the vehicles were acting in a suspicious manner, and also determined that one of them had battered the driver of the other vehicle prior to police arrival. As the officer—still alone—attempted to frisk one of the suspects, the suspect (6', 200 pounds) turned and attempted to punch the officer. The officer backed away, and the suspect moved towards him in an aggressive manner. The officer deployed the Taser, and was able to take the suspect into custody. This incident—a single officer facing multiple, hostile suspects—would likely have resulted in injuries to the officer or the suspects without the Taser.
- An officer working the night shift was attempting to locate a motorcycle that was fleeing from him. The officer located the motorcycle and rider, laying in the roadway on a curve. As the officer pulled up, the rider got up and began lifting the cycle to continue his flight. The suspect refused to comply with the officer's directions, and a brief struggle ensued. The suspect broke free from the officer and again tried to flee on the motorcycle. The officer deployed his Taser, and the suspect was taken into custody. The Taser deployment in this incident prevented the risk to officers and citizens associated with vehicle pursuits.

- MPD officers were assisting an outside agency with a barricaded suicidal subject who was believed to be armed. The subject refused to surrender, and indicated that he was armed. During the incident, the subject also illuminated officers on the perimeter with a high-powered spotlight. The subject indicated that he had taken an overdose, then exited the residence, still refusing to comply with officers. An MPD sergeant deployed the Taser, and the subject was taken into custody without injuries. This deployment prevented the subject from re-entering his residence and arming himself, and allowed officers to provide emergency medical care to the subject.
- Officers responded to a robbery that occurred downtown. Six suspects had fled on foot, and officers engaged in multiple-foot pursuits. One officer chasing a suspect drew his Taser, and projected the laser aimpoint on the ground in front of the suspect. The suspect immediately stopped and complied. Elsewhere, two officers had flushed four of the suspects out of a wooded area. The four suspects fled towards perimeter officers, one of whom drew her Taser. One of the suspects recognized this, telling the others, "she's got a Taser." All four suspects stopped and complied at that point.
- Two night-shift officers contacted two subjects believed to be involved in drug activity in a bar parking lot. The driver quickly started the car and attempted to put it in gear. One of the officers leaned in the car and struggled with the suspect, attempting to prevent him from starting the car. Before the driver was able to put the car in gear, the Taser was deployed, preventing him from operating the car. The bar parking lot was crowded with people, and the Taser deployment prevented the suspect from posing a risk to the officers and bystanders.

Distance

The maximum range of the Taser probes is 21 feet (note that a new air cartridge manufactured by Taser International but not yet deployed by MPD has a range of 25 feet). The Taser probes/wires spread out as they travel away from the officer (the probes spread 1 foot for every 7 feet they travel), resulting in a wider spread between probes at longer distances (the bottom probe will impact 3 feet below the top one at the maximum range of 21 feet). As a result, it can be more difficult to ensure that both probes will impact the target at long distances. As might be expected, the majority of Taser deployments occurred at relatively close range (11 feet or less):

Distance	Deployments (92 total)
Drive-stun	31
1-3 feet	12
4-7 feet	20
8-11 feet	20
12-15 feet	6
16-21 feet	3

Injuries

The Taser fires two small metallic probes which, if they impact the body, create very small punctures (similar to mosquito bites). In many cases the probes don't impact the skin, and simply connect with the clothing. Only a small number of the incidents in which Tasers were deployed resulted in any injury (to either officers or suspects) beyond the minor punctures sometimes caused by the Taser probes:

Incidents in which suspects were injured (beyond probe punctures)	6
Suspect injuries requiring medical treatment	2
Incidents in which officers were injured	3
Officer injuries requiring medical treatment	1

Of the suspect injuries, two were due to the suspect falling as result of the Taser incapacitation (both resulted in minor injuries, one required medical attention and 7 sutures). Three of the suspects sustained minor scrapes struggling with officers or being handcuffed (none requiring medical attention). One suspect was shot with a firearm during the incident (requiring medical attention).

Of the officer injuries, one was a minor scrape caused by an officer falling during a foot pursuit (the Taser had been deployed prior to the foot pursuit but was ineffective, likely due to a probe falling out or wire breakage), no medical attention was required. Two officers sustained minor injuries during the incident in which the suspect was shot (not requiring medical attention). One officer sustained a dislocated shoulder in a struggle with a suspect after Taser deployment (the Taser was only marginally effective, due to heavy clothing), medical attention was required.

Time of Day

The majority of Taser deployments occurred on MPD's 2nd and 3rd shifts:

Shift	Deployments	Percentage
1 st	9	10%
2 nd	40	43%
3 rd	43	47%

While Taser-trained officers were distributed across patrol shifts fairly evenly, a number of neighborhood officers and CPT officers—all working primarily evening hours—were Taser trained. While this may have contributed to the disparity in Taser deployments between day hours and evening/night hours, it is likely that the difference simply reflects MPD staffing allocations, as well as the volume and nature of calls for service on the different shifts.

Subject Age

The majority of Taser deployments were against subjects between the age of 19 and 43. The youngest subject a Taser was deployed against was 14, the oldest was 60.

Age Range	Number of Subjects	Percentage *
14-18	7	8%
19-23	15	18%
24-28	17	20%
29-33	12	14%
34-38	13	16%
39-43	10	12%
44-48	5	6%
49-53	2	2%
54 +	2	2%

* Percentages are rounded, as a result they do not add up to 100

It is not clear if other use-of-force tools/techniques employed by MPD officers are applied to various age groups in a pattern similar to that of the Taser. However, a review of MPD arrest data (for 2003)—showing percentages of total MPD arrests by age—is relevant:

Age Range	Percentage of Total MPD Arrests
14-18	24%
19-23	34%
24-29	12%
30-34	7%
35-39	7%
40-44	7%
45-49	5%
50-54	3%
55-59	1%
60-64	Less than 1%
65 +	Less than 1%

While the utilization of the Taser against subjects in the 14-18 year-old age range has created some controversy locally, this data suggests that MPD officers exercise considerable restraint with respect to

deploying Tasers during arrests of subjects in that age range (accounting for 24% of arrests but only 8% of Taser deployments).

Race/Gender

The race and gender of the 83 subjects against whom the Taser was deployed:

Gender/Race	Deployments	Percentage
M/W	36	43%
M/B	30	36%
M/A	1	1%
M/H	5	6%
F/W	7	8%
F/B	4	5%

MPD arrest data (from 2003) shows that MPD arrest rates (by race) are comparable (arrest rates: white: 63%; black: 34%) to Taser deployment rates (by race).

Location

Taser deployments by MPD district:

District	Deployments	Percentage
East	12	13%
North	20	22%
Central	18	20%
South	16	17%
West	24	26%
Outside City*	2	2%

* One of these incidents was an MPD officer assisting an outside agency; one was an MPD pursuit that ended outside of the City.

For comparison, this data can be compared to MPD calls for service and violent crimes reported (by MPD District):

District	2003 Calls for Service (percentage of MPD total)	2003 Violent Crimes (percentage of MPD total)
East	14%	13%
North	17%	15%
Central	28%	29%
South	15%	19%
West	23%	25%

When determining which officers to train in use of the Taser, consideration was given to district, so Taser trained personnel (in 2004) were split across districts fairly evenly. These numbers indicate that Taser deployments by geographic area are fairly consistent with overall demand for police services.

Criminal Charges

The 83 subjects who were taken into custody during incidents in which the Taser was deployed accounted for a total of 30 felony and 144 misdemeanor charges (as a result of the incidents). 13 of the subjects were taken into custody for a non-criminal reason (protective custody, mental health commitment, emergency detention, etc.).

Resulting Charges to Subject	Number	Percentage
Misdemeanor Charges Only	49	59%
Misdemeanor & Felony Charges	20	24%
Protective Custody, Emergency Detention, etc.	13	16%

*Resulting charges in one incident - where an MPD officer deployed the Taser while assisting another police agency - are unknown.

Weapons

Officers trained to use Tasers are clearly instructed that the Taser is not a substitute for deadly force. It would be inappropriate under MPD policy for an officer faced with a potential deadly force encounter to utilize a Taser. However, if another officer is present at a scene with the ability to immediately deliver deadly force, it would be appropriate for an officer to arm him or herself with a Taser (and deploy it, if appropriate). That being said, some of the suspects involved in Taser incidents were armed:

Number of armed suspects (actual Taser deployments)	6
Number of armed suspects (incidents where Taser was displayed or Taser use was threatened)	3

Taser Display Or Threatened Use

In Spring of 2004, when the Taser program was expanded, Taser-trained officers were instructed not only to forward all reports involving actual deployments of Tasers to me, but to also route reports where officers displayed or threatened to deploy a Taser in order to gain compliance from a suspect. In 47 instances, officers gained compliance from suspects by displaying or threatening to deploy the Taser. These suspects were taken into custody with no physical force being used, and with no injuries to officers or suspects. Notably, some of these instances involved suspects who refused to comply when confronted with firearms; only when the Taser was displayed did the suspect comply. Some suspects reported being aware of the Taser and its capabilities, and consciously choosing not to resist as a result.

Officers initially trained in the use of the Taser (in 2003) were not instructed to forward these reports to me, so it is likely that the total number of these cases is slightly higher.

Many of these instances involved suspects that were displaying behavior indicative of significant resistance. There can be little doubt that most of these instances would have resulted in physical confrontations without the presence of the Taser, and that at least some of these physical confrontations would have resulted in injuries to the suspect, officers, or both. Several of these incidents involved subjects who were armed; those easily could have escalated to deadly force encounters without the Taser's presence.

Citizen Complaints

The department has received no citizen complaints about any of the Taser deployments.

SUCCESS OF MPD TASER PROGRAM

At the outset of the MPD Taser program, our belief was that deploying the Taser with MPD officers would achieve two primary goals:

- A reduction in injuries to officers and suspects from use-of-force encounters.
- A reduction in officers' utilization of deadly force.

To fully understand the benefits of the Taser, a brief discussion of police use-of-force is in order. The purpose of police use-of-force is to gain control of a subject in pursuit of a legitimate law enforcement objective. Officers can use that degree of force that is reasonable and necessary under the circumstances. The U.S. Supreme Court has articulated three general factors that will be used to evaluate the reasonableness of a police use-of-force:

- The severity of the crime.
- Whether the suspect poses a threat to the safety of officers or citizens.
- Whether the suspect is actively resisting arrest or attempting to evade arrest.

The reasonableness of an officer's actions will be judged based on what information the officer knew at the time of the incident (not through 20/20 hindsight). Officers are not required to use the minimum amount of force in any given situation; the constitutional standard is reasonableness.

In Wisconsin, a force continuum serves as a framework for officers in making use-of-force decisions:

<u>Mode</u>	<u>Tactic</u>	<u>Purpose</u>
Presence	Professional Presence	To present a visible display of authority
Dialog	Tactical Communication	To verbally persuade
Empty Hand Control	Escort Holds	To safely initiate contact
	Compliance Holds	To overcome passive resistance
	OC Spray	To overcome active resistance or its threat
	Passive Countermeasures [Taser]	To decentralize
	Active Countermeasures	To create dysfunction
	Incapacitating Techniques	To cause the immediate, temporary cessation of violent behavior
Intermediate Weapon	Intermediate Weapons [Less Lethal Projectiles]	To impede a subject
Deadly Force	Firearm	To stop the threat

[Note that the State of Wisconsin does not currently incorporate the Taser or less lethal projectiles into the force continuum, they are reflected above as placed in the continuum under MPD policy.]

Officers are authorized to initially use the level and degree of force that is reasonably necessary to achieve control; it is not necessary to escalate step-by-step through the continuum. Tools/techniques located near the bottom of the continuum (tactical communication, escort holds, etc.) are very unlikely to cause injury, but are also very unlikely to gain control of a non-compliant subject. Tools/techniques located near the top of the continuum (the intermediate weapon—the baton; or active countermeasures—punches, kicks, forearm strikes or knee strikes) are more likely to gain control of a non-compliant subject, but are also much more likely to cause injury. So, tools/techniques that would be used as alternatives to the Taser are more likely to cause injury (indeed, if they are done properly, they will cause injury) than the Taser, but are less likely to be effective than the Taser (particularly when dealing with extremely resistive/violent subjects).

Injury reduction - As indicated above, use-of-force incidents involving the Taser resulted in very few injuries. There were 130 total use-of-force incidents involving Tasers (83 incidents involving actual deployments, and 47 where officers threatened to use or displayed the Taser). Given the alternative use-of-force tools/techniques (baton strikes, punches, kicks, etc.) officers would have employed in many of the incidents where the Taser was deployed, and the high propensity for those tools/techniques to cause injury, there is no question that both the number and severity of injuries (to both officers and suspects) would have been far higher but for the Taser.

<u>Injury Type</u>	<u>Number</u>	<u>Percentage of Taser Incidents</u>
Incidents in which suspects were injured	6	5%
Suspect injuries requiring medical treatment	2	2%
Incidents in which officers were injured	3	2%
Officer injuries requiring medical treatment	1	Less than 1%

National studies have consistently shown that police use-of-force encounters often result in injuries to officers and suspects. Comparing these figures to injury rates from MPD use-of-force encounters involving the Taser shows that the Taser does lead to a reduction in injuries to both officers and suspects:

	<u>Percentage of MPD use-of-force incidents involving Taser</u>	<u>National Averages, all use-of-force incidents</u>
Injuries to Officers	2%	10%
Injuries to Suspect	5%	38%

As part of the process of researching the Taser and proposing an MPD Taser program, MPD officer injuries (resulting from physical confrontations with suspects) were analyzed (by reviewing MPD worker's compensation forms). Comparing that data (from 2002) with similar data collected from 2004 also illustrates the benefit on overall MPD officer injuries since the Taser was deployed:

	2002	2004
Incidents where MPD officers were injured during physical confrontations with suspects	90	68
Missed work days by officers as a result of these injuries (worker's comp days)	29	26
Light duty days as a result of these injuries	54	25
Using average MPD officer salary, value of missed work time	\$24,714	\$15,899

This reduction cannot necessarily be correlated only to the Taser, but it does further indicate the benefit of the Taser. It is also important to note that Taser deployment was not expanded until Spring of 2004 (so for the first few months of the year, there were only a handful of Taser-trained officers and only two Tasers available for use), that only a limited number of officers are Taser trained, and that only a limited number of Tasers are available for checkout. Expanded deployment of the Taser would likely further reduce officer and suspect injuries.

Deadly Force Utilization – As indicated above, a number of incidents where the Taser was deployed allowed officers to avoid having to resort to the use of deadly force. Also, some of the incidents in which displaying or threatening to use the Taser resulted in compliance could have very easily escalated to deadly force encounters. As such, the Taser clearly has reduced MPD officers' utilization of deadly force.

TASER SAFETY

When we first researched and deployed Tasers in 2003, there was strong evidence demonstrating the Taser's safety. Since then, several new reports on Taser safety have been released. The most notable was conducted by the Department of Defense (Human Effects Center of Excellence). While the full report is not yet available, a summary has been released. The summary states:

[U]se of the Taser M26 and X26, as intended, will generally be effective in inducing the desired temporarily incapacitating effect without presenting a significant risk of unintended severe effects.

The summary also stated:

...increased use of the Taser M26 or the Taser X26 has decreased the overall injury rate of both police officers and suspects in conflict situations when compared to alternatives along the use-of-force continuum.

Another Taser safety study was recently published in a peer-reviewed cardiac physiology medical journal (Pacing and Clinical Electrophysiology), concluding that the X26 Taser has a wide margin of safety. The study concluded that 20 times the standard X26 output is required to induce ventricular fibrillation in a subject weighing 100 pounds. The safety margin increased with larger body sizes:

Body Weight (pounds)	X26 Safety Margin
66	15x
82	18x
108	22x
119	30x
183	36x
258	42x

The study also showed that heart rhythm and blood pressure remain unchanged during the Taser cycle. The study's conclusion stated:

This study confirmed the cardiac safety of an experimental NMI (Taser) device emulating the performance of commercially used devices. An NMI discharge that could induce VF (ventricular fibrillation) required 15-42 times the charge of the standard NMI discharge. Furthermore, this study demonstrated a safety index strongly correlated with increasing weight. In addition, the observation of the hemodynamic stability of the animals suggests that these devices may be safely applied multiple times if needed. Discharge levels output by fielded NMI devices have an extremely low probability of inducing VF.

Also, the Defence Scientific Advisory Council (United Kingdom), undertook an extensive research study into Taser safety. The study's conclusion, released in July of 2004: "The risk of life-threatening or serious injuries from the M26 Taser is very low."

Over the past year, however, a number of media outlets have questioned the safety of the Taser, suggesting that Taser deployments have been responsible for the deaths of a number of subjects. These media outlets—primarily The Arizona Republic (a daily newspaper in Phoenix, AZ)—have cited a number of cases where subjects died after Taser deployments (so called "Taser related" deaths). A close analysis of these cases, however, demonstrates the inaccuracy of the media implications. I reviewed 90 cases (mostly reported by The Arizona Republic) occurring between 1999 and 2005 involving the Taser and the eventual death of a suspect. That review showed:

Of the 90 cases:

- 89 involved significant physical exertion (fleeing or fighting) on the part of the suspect.
- In 41 out of the 51 cases for which information was available, the suspect had ingested controlled substances—usually cocaine, but also including PCP and methamphetamine prior to police contact (in 39 of the cases drug information was not available).
- In 54 out of the 59 cases for which information was available, there was a significant time delay between the application of the Taser and the suspect's death—sometimes up to a week (information was not available for 31 cases). This is a clear indication that the Taser did not contribute to these deaths (electricity is not stored in the body—if an electrical current is sufficient to cause ventricular fibrillation, it will do so immediately).
- Most involved violent struggles with police, in which other use-of-force tools/techniques (such as OC spray, baton strikes, beanbag rounds, and empty hand techniques) were utilized.

These cases were included as "Taser related" deaths:

- 2 subjects who were shot (with firearms) by police after Tasers were deployed unsuccessfully.
- 2 subjects who died from head injuries (1 from a fall after Taser deployment, 1 prior to police arrival).
- 1 subject who slit his wrist prior to police contact and died as a result.
- 1 subject who filled his home with natural gas prior to police contact—when the Taser was deployed the house exploded, killing the subject and injuring two officers.

What did the coroners/medical examiners in these 90 cases say?

- In 46 cases the cause of death was unknown, or the autopsy is unavailable. Most of these cases involved drug ingestion and/or a delay between Taser application and death.
- In 23 of the remaining 44 cases, the death was attributed to lethal drug consumption
 - In 8 of these cases the autopsy report specifically excluded the Taser as a contributing factor
 - In 3 of these cases the role of the Taser was deemed to be unknown

- In 9 of the remaining 21 cases, the death was attributed to medical causes, usually cardiac arrest due to physical exertion or pre-existing disease
 - In 5 of these cases the autopsy report specifically excluded the Taser as a contributing factor
 - In 2 of these cases the role of the Taser was deemed to be unknown
- In 6 of the remaining 12 cases, the death was attributed to trauma unrelated to the Taser (gunshots, etc.)
- **None** of the autopsy reports ruled or suggested that the Taser was a primary cause of any death.
- In 6 cases the Taser was deemed to have contributed to the subject's death; all 6 findings are highly speculative and a review of the incidents suggests that the Taser played no causative role in any of the deaths:

James Borden (47 years of age, Monroe County, Indiana)

- Multiple drive-stuns delivered to lower abdomen and buttocks during struggle in jail.
- Borden had a massively enlarged heart (twice the normal size) and had toxic drug levels present in his body.
- A national forensic expert (Cyril Wecht) reviewed the case and concluded that the Taser did not cause or contribute to the death.
- The original coroner has since stated that the pain from the Taser—rather than the current itself—frightened Borden, causing him to have a heart attack (all police use-of-force tools/techniques will cause pain, however, so the use of any tool/technique during this incident would have led to the same result).

William Lomax (26 years of age, Las Vegas, Nevada)

- Lomax, under the influence of PCP, engaged in a violent struggle with police. He died 19 hours after the Taser deployment.
- The coroner's report attributed the death to "cardiac arrest during restraint procedure" with "PCP intoxication" listed as a secondary cause.
- A coroner's inquest jury (not medical professionals) issued an opinion stating "the combination of the force of the knee in his back, the TASER, his drug use, and the restraining: they all played an equal role in his demise."
- No experts in Taser safety or technology testified at the inquest.

William Teasley (31 years of age, Anderson, South Carolina)

- Large subject became violent during booking process, Taser deployed.
- Teasley had numerous medical problems: his heart and spleen were enlarged, his liver weighed twice as much as a normal one, he had hardened arteries and a constricted airway.
- Medical examiner stated that the Taser alone did not cause the death, but stated, "in the dominoes of this man's existence, this Taser was the last straw."

Greshmond Gray (25 years of age, LaGrange, Georgia)

- Subject resisted officers, Taser deployed.
- After first Taser deployment, subject attempted to pick up a small grill filled with hot coals, Taser deployed again.
- Subject had a history of cocaine use, and an abnormal heart.
- Coroner ruled that the emotional and physical stress the subject went through during the struggle with police, including the Taser deployment, led to a lethal heart rhythm.

Milton Salazar (29 years of age, Mesa, Arizona)

- Hours after being released from prison, Salazar began throwing rocks at motorists.
- Salazar resisted officers and Taser was deployed, he died two days later.
- Tests showed the presence of cocaine in Salazar's system.
- Medical Examiner ruled that Salazar died from complications from excited delirium due to cocaine intoxication, but added that the Taser and stress from the struggle with police contributed.

Michael Rosa (38 years of age, Del Rey Oaks, California)

- Rosa was wandering through yards and screaming; when police approached he swung a 2x4 piece of wood at them.
- Rosa was taken into custody after Taser deployment, he died later at the hospital.
- The coroner ruled that Rosa died of a heart attack due to methamphetamine intoxication, but listed the Taser and the struggle with police as contributing factors.

So, in most of the cases cited by media outlets as "Taser related" deaths, the Taser can readily be eliminated as a factor in the suspect's death. In those few cases where coroners or medical examiners mentioned the

Taser as a possible factor in the death, circumstances suggest otherwise. No coroner or medical examiner has ruled that the Taser was the primary cause of any death.

The summary of the Department of Defense study on Taser safety (discussed above) also spoke to the subject of in-custody deaths associated with the Taser: **“based on the documentation and research reviewed, this report concludes that (the Taser) is likely not the primary causative factor in reported fatalities.”**

The delay between Taser application and death in most of these incidents forecloses the Taser as playing a role in those deaths. UW-Madison professor of biomedical engineering John Webster:

If people are electrocuted, then the heart stops pumping. In about five seconds the blood pressure goes to near zero. Within about 30 seconds, the person faints and collapses. Most of the incidents of persons dying after being “Tasered” don’t fit this situation.

A 1991 report in the Journal of Forensic Sciences reviewed 16 in-custody deaths associated with Taser use (those cases involved an earlier model of Taser, manufactured by a different company, however). The study concluded that the Taser does not cause death and ruled out the Taser as a factor in fifteen of the cases. The study concluded that in one of the cases, the Taser could not be ruled out as a contributing factor (“the subject’s heart condition was such that he could have suffered a fatal arrhythmia from the PCP, the excitement, the electrical stimulation or any of these factors”).

Suspect deaths in police custody are not new; indeed, such incidents have occurred previously in Madison. It is estimated that between 50 and 125 police in-custody deaths occur each year. These incidents are almost always associated with a condition known as Excited Delirium:

A state of extreme mental and physiological excitement, characterized by extreme agitation, hyperthermia, euphoria, hostility, exceptional strength and endurance without fatigue.

Excited delirium typically results from excessive or chronic drug use, or from certain types of severe mental conditions. It is characterized by bizarre and violent behavior, incredible strength, paranoia, incoherent shouting, overheating, profuse sweating, and being impervious to pain. The erratic behavior engaged in by these individuals results in police response, and a violent struggle typically ensues. Because the subject suffering from excited delirium is experiencing paranoia, is impervious to pain and temporarily exhibits extraordinary strength and endurance, these confrontations are extremely dangerous and challenging for police. The subject—feeling no pain and behaving irrationally—exerts him or herself far beyond the limits of the body and heart, sometimes resulting in death. As the Taser continues to be used more widely by police agencies, it is not unusual that some of these in-custody deaths will occur after incidents in which the Taser was used. Indeed, almost all of the incidents cited by The Arizona Republic appear to be instances of Excited Delirium. To conclude that the Taser caused any of these deaths is simply not accurate.

Dr. Jan Garavaglia, Chief Medical Examiner for Orlando, Florida, spoke to the issue of Excited Delirium and the Taser (July 2004):

It is my belief that Taser use is now associated with Excited Delirium, because it’s associated; that’s how they’re bringing them down, but there’s really no evidence that they’re causing any of the deaths...Excited Delirium is now a fatal disease, whether the police interact or not...I believe these individuals would have died with or without being shot with a Taser.

A United States Department of Justice study into the safety of OC spray (conducted in the mid-90s) also sheds some light on the issue of police in-custody deaths. The DOJ study reviewed 73 cases in which subjects had died after being exposed to OC spray. The study pointed out that when OC spray was new (like the Taser is now), safety concerns developed: “as pepper spray use began to spread, questions arose as to its safety, especially after several exposed arrestees died in custody.” The DOJ study concluded that OC spray

contributed to only two of the deaths, both involving suspects who suffered from asthma. A few points from the DOJ's OC study are relevant to the topic of Taser safety and in-custody deaths:

- A review of the facts associated with the individual incidents in the DOJ study show striking similarities to the cases cited by the Arizona Republic (almost all of them showing symptoms of Excited Delirium). Most involve suspects who have either ingested controlled substances or have pre-existing medical conditions. The suspects engage in some type of behavior requiring police intervention, and then proceed to engage in violent confrontations with officers. These similarities demonstrate that police in-custody deaths are to be expected in a small number of police use-of-force encounters, and that the suspect's exertion while resisting—rather than any particular tool or technique used by the police—leads to the death.
- Conclusions reached by medical examiners or coroners are opinions, and necessarily entail some degree of subjectivity. The DOJ report stated, "[T]he author did not always agree with the cause of death listed by the autopsy surgeon or the medicolegal officer." Indeed, a review of the Arizona Republic cases shows a number of very similar incidents where the medical examiner/coroner reached different conclusions. The Arizona Republic emphasizes the few autopsy reports concluding that the Taser contributed to a death, but discounts the autopsy reports expressly ruling that the Taser played no role in a death.
- The DOJ study stated, "the studies cited in this report do not and cannot prove that pepper spray will never be a contributing factor in the death of a subject resisting arrest." So, while unable to definitively state that OC spray is "safe," the DOJ study concluded that all but two of the deaths associated with the use of OC spray would have occurred even if OC spray had not been used.
- Despite the lack of a definitive conclusion in the DOJ report, the vast majority of police officers in the United States carry and use OC spray.

A review of 38 police in-custody deaths during a two-month period in 2004 showed that 9 of the cases (24%) involved Taser use, while 29 (76%) did not. Since about 30% of law enforcement agencies in the U.S. deploy Tasers, this suggests that in-custody deaths involving the Taser comprise a percentage of all police in-custody deaths proportionate to overall Taser deployment.

None of the media stories casting doubt upon the safety of the Taser has cited any type of medical or scientific study or research to support their claims. Indeed, there is no research suggesting any safety concerns with the Taser. Information available in 2003 when MPD first deployed the Taser strongly indicated that the device was safe. While the past year's media attention has raised doubts about Taser safety among the uninformed, available information continues to demonstrate that the Taser is a safe device. MPD's Taser experience (close to 300 deployments, including volunteer exposures, with only a few minor injuries and no long-term adverse consequences) further demonstrates this.

OTHER TASER ISSUES

Policy

MPD policy on Taser use has changed in several respects since the program's inception. Initially, the Taser was placed at two distinct locations on the force continuum: if used in the drive-stun mode, the Taser was placed at the compliance hold level; if used by firing probes, the Taser was placed above takedown techniques but below active countermeasures. The reason for the distinction was primarily the differing propensities for injury: firing the probes creates a small risk for injury (primarily due to the potential for an uncontrolled fall), while the drive-stun carries virtually no potential for injury. After reviewing Taser deployments for the first

few months of expanded deployment (mid-2004), we realized that a few deployments in the drive-stun mode, while in compliance with the policy at that time, did not reflect circumstances under which we wanted Tasers to be deployed. As a result, in June of 2004 MPD's policy on Taser use was changed, putting any Taser use at the same point on the force continuum (above takedown techniques but below active countermeasures). 86% of agencies deploying the Taser place it on the continuum at the same level as OC spray, and The International Association of Chiefs of Police (IACP) model policy on electric weapons equates the devices with OC spray. So, MPD's current policy is slightly more restrictive than the IACP recommended policy and that of most agencies deploying the Taser.

At the time the above change was made, this section was also added to the Taser section of the use-of-force policy:

The Taser shall not be used once an individual is subdued and under control, nor shall it be used against subjects who are offering passive resistance.

At the inception of the MPD Taser program, officers were required to have medical staff (at an emergency room) remove the Taser probes (if they were embedded in the subject's skin). Officers found that ER staff removed the probes in the same way Taser International trains officers to remove them. Accordingly, the policy was changed to allow officers to remove probes in the field. Probe removal was incorporated into the Taser user training as well. Probes embedded in a sensitive area of the body will still have to be removed by medical personnel.

Volunteer Exposures

Since the inception of the MPD Taser program, close to 200 people have volunteered to be exposed to the Taser. Most of these volunteers have been MPD officers going through Taser training (Taser exposure is highly recommended, but not required, for officers being trained in use of the Taser; only a handful did not volunteer). In 2004, Officer Eric Anderson provided training on police use-of-force and possible resulting injuries to the Madison Fire Department. More than 60 MFD personnel volunteered to be exposed to the Taser. One media representative has also volunteered. None of these individuals sustained any injury during the exposure, and no adverse effects have been reported.

Deployment Problems/Effectiveness

The Taser user training underscores the Taser's great effectiveness. The volunteer Taser exposures most officers were subject to (under controlled conditions) can create the belief that the Taser will always be effective. Not surprisingly, in actual field deployments many things can (and do) go wrong that hinder the Taser's effectiveness. The primary issues MPD officers have faced are clothing (thick or baggy) or probe misses. Officers are recognizing that the Taser, while a great tool, is not a cure-all.

Reliability

MPD was one of the first agencies to purchase the X26, and as a result our initial order of 31 were some of the earlier ones manufactured. 16 X26's have had to be returned to Taser International, for a variety of problems. All but one of these malfunctions were detected either during training or through spark-testing. Only once did an X26 malfunction (fail to spark when deployed) during a field deployment.

Taser International has replaced each of these X26's, and had provided a few extra X26's at no cost to the department. It appears that the malfunctions may be attributable to early problems in the X26 manufacturing process. Tasers received after the initial order (with higher serial numbers, from later manufacturing lots) have proven to be more reliable.

CONCLUSIONS

MPD's deployment of the Taser has clearly been a success. The Taser has been utilized to resolve more than 100 use-of-force encounters, with few resulting injuries to officers or suspects. Given the alternative force

options that would have been utilized in these encounters, there is no question that both the number and severity of injuries (to both officers and suspects) would have been far greater had the Taser not been available. The Taser has also allowed officers to avoid having to deploy deadly force in a handful of incidents, and has also likely precluded other incidents from escalating to deadly force encounters.

The fact remains, however, that most MPD officers have not been trained in the use of the Taser. Each shift, most MPD patrol officers working the street are not equipped with Tasers, either because they have not been trained in use of the Taser, or because there are no Tasers available for Taser-trained officers to check-out. As a result, many MPD use-of-force encounters continue to be handled with traditional tools/techniques. These incidents are resulting in injuries to both officers and suspects that could be avoided with expanded Taser deployment.

Attachments

Summary of all MPD Taser deployments

Summary of all incidents where Taser use was threatened, or Taser was displayed

July 2003 - January 2005

Date	Officer	Location	Probes/Stun	Distance	S/R	Age	Taser	Case Number	Comments	Charges	Armed?
7/18/2003	Wahl	4765 Hayes Rd.	Probes	7 feet	M/B	35	M26	03-84278	Large subject barricaded in hotel bathroom; very effective	Mental Commitment	
8/1/2003	Skenadore	Bellline/Verona Rd.	Probes	10 feet	F/W	19	M26	03-90516	Suicidal female, 1 probe hit backpack; still taken into custody w/no escalation	ED	
8/2/2003	Samson	100 E. Main	Drive-Stun	na	M/H	28	M26	03-91086	Non-compliant subject on ground, drive stun effective	1 misd	
8/6/2003	Quast	Bram/Beld	Probes	10 feet	M/B	37	M26	03-93234	Armed robbery suspect, attempted suicide by cop; very effective	1 misd; 1 felony	
8/9/2003	Skenadore	1754 Thierer Rd.	Probes	10 feet	M/B	44	M26	03-94374	Suicidal subject, cutting self w/razor; very effective	PC Conveyance	Yes
8/9/2003	Skenadore	2914 Industrial Dr.	Drive-Stun	na	M/W	30	M26	03-94645	Resistive subject at detox; drive-stun effective	PC Conveyance	
8/25/2003	Quast	1709 Fisher St.	Probes	8-9 feet	M/W	42	M26	03-101694	Suicidal subject, noncompliant, probes hit - marginal effectiveness; poss. Low muscle mass	3 misd	
10/9/2003	Samson	2678 S. Stoughton Rd	Probes	10 feet	M/W	26	M26	03-122690	Suicidal w/large knife, also threatening to charge officers; 2 cycles, very effective	1 felony; P&P	Yes
10/16/2003	Quast	401 West Shore Dr.	Drive-Stun	na	M/H	35	M26	03-125810	Non-compliant subject on ground after foot pursuit; drive stun effective	1 misd	
10/22/2003	Freedman	1500 Adams St.	Drive-Stun	na	M/W	29	M26	03-127193	Resistive subject on ground; drive-stun effective	2 misd	
2/17/2004	Freedman	2809 Curry Pkwy.	Probes	8-10 feet	M/W	22	M26	04-17315	Large, uncooperative subject w/history of resistance; probes very effective	Unk (asst. TMPD)	
4/6/2004	McClurg	4101 Commercial Ave.	Probes	12 feet	M/W	41	S2	04-36669	Subject in vehicle, probes hit vehicle and not subject	1 misd; 3 felony	
4/6/2004	Olt	4101 Commercial Ave.	Drive-Stun	na			C21	04-36669	Drive-stun on above subject during struggle		
4/7/2004	Grann	4222 E. Washington	Drive-Stun	na	M/W	22	C23	04-37163	Drive-stun after foot pursuit; effective	1 misd; 1 felony; P&P	
4/8/2004	Grann	E. Wash & 6th	Drive-Stun	na	M/B	34	C24	04-37597	Drive-stun, not effective	2 misd	
4/17/2004	B. Gonzalez	517 Woodward	Probes	5 feet	M/B	40	N16	04-41285	Large uncooperative suspect, 2 firing cycles, effective	4 misd	
4/18/2004	Brennan	E. Main & Webster	Probes	16-20 feet	M/B	28	C21	04-41694	Large suspect turned on officer after foot pursuit; effective	1 misd; P&P	
4/22/2004	Matt Schroedl	15 Buhler Ct.	Probes	4-5 feet	M/W	36	N18	04-43386	Suicidal subject w/knife; effective	PC Conveyance	Yes
4/24/2004	Grann	605 Cottage Grove Rd.	Drive-Stun	na	F/W	50	C22	04-44320	Noncompliant suspect refusing to enter squad; drive-stun effective	PC Conveyance	
4/26/2004	Kobinsky	4601 Verona Rd.	Drive-Stun	na	F/W	25	W12	04-45355	Combative in squad (cuffed) kicked window, shattering it; drive-stun effective	2 misd	
5/3/2004	Alvarez	CCB	Drive-Stun	na	M/H	27	C30	04-48549	Resistive subject in holding cell; drive-stun effective	1 misd	
5/6/2004	McClurg	Hwy V	Probes	3 feet	M/W	42	S2	04-49523	Resistive suspect at end of lengthy pursuit, extended deployment, very effective	2 misd; 2 felony; P&P	
5/8/2004	Wiering	2014 Allied Dr.	Probes	1-3 feet	F/B	26	W7	04-50439	Resistive subject, probes missed	1 misd; P&P	
5/8/2004	Wiering	2014 Allied Dr.	Drive-Stun	na			W7	04-50439	Follow-up drive-stun after probes missed and suspect taken to ground, effective		
5/14/2004	Herrera	100 S. Pinckney	Probes	1-3 feet	F/B	21	C24	04-53047	Handcuffed suspect, resisting and attempting to kick officers, effective	2 misd; 1 felony	
5/14/2004	Herrera	100 S. Pinckney	Drive-Stun	na	F/B	21	C24	04-53047	Suspect struggling with officers attempting takedown, drive-stun effective	2 misd	
5/16/2004	Patterson	500 State St.	Probes	6 feet	M/W	26	C28	04-54085	Large violent suspect in major disturbance, probes very effective, 3 cycles	3 misd	
5/20/2004	Grann	1798 Thierer Rd.	Probes	12-15 feet	M/B	44	C29	04-55720	Large resistive subject after foot pursuit; effective; 2-3 cycles	2 misd	
5/25/2004	Kellogg	432 State St.	Drive-Stun	na	M/B	48	C26	04-58280	Resistive subject, drive-stun effective	1 misd	
5/27/2004	D. Dexheimer	1542 Troy Dr.	Probes	10 feet	F/W	34	N15	04-58389	Probes bounced off suspect, no effect	1 misd; 1 felony	
6/3/2004	Fiore	755 Braxton Pl.	Probes	8 feet	M/W	36	S1	04-62182	Intoxicated & uncooperative suspect; probes effective; minor injury as a result of fall	1 misd	
6/3/2004	Armogost	4702 Cottage Grove	Probes	5 feet	M/W	80	C23	04-62077	Suspect armed with knife, probe deployment effective	2 misd; 1 felony	Yes
6/5/2004	Kobinsky	1240 McKenna	Probes	9 feet	M/B	23	W8	04-61536	Probes fired at suspect in foot pursuit, missed	3 misd	
6/5/2004	Kobinsky	1240 McKenna	Drive-Stun	na			W8	04-61536	Drive-stun after foot pursuit; effective	1 misd	
5/23/2004	Pharo	2418 Willard Av.	Drive-Stun	na	M/W	16	N19	04-57064	Subject in squad spilling; drive-stun used	3 misd	
6/3/2004	Fiore	4315 Bridge Rd	Drive-Stun	na	M/W	27	S1	04-62031	Incoherent/resistive subject in swimming pool; drive-stun somewhat effective	7 misd	
6/8/2004	B. Gonzalez	500 N. Oak	Probes	6-7 feet	M/W	28	N15	04-64038	Probes fired at suspect in foot pursuit after 10-80; effective; 2 cycles	2 misd; 2 felony	
6/14/2004	Reilly	900 Williamson St	Probes	5 feet	M/H	28	C27	04-66893	Initial minor effect, then not effective; likely due to close probe spread & low muscle mass	5 misd; 5 felony	
6/14/2004	Reilly	900 Williamson St.	Drive-Stun	na			C27	04-66893	Multiple drive-stuns; pre-shooting not effective; post-shooting marginal effectiveness		
6/14/2004	D. Xiong	100 S. Thompson	Probes	16-21 feet	M/W	21	C22	04-67375	Probes fired, not effective. Appears one probe stuck in clothing but too far from skin to complete cycle	1 misd	
6/16/2004	D. Xiong	3737 E. Washington	Probes	3 feet	M/W	23	C25	04-67923	Probes fired at suspect in vehicle; initially effective		
6/16/2004	Grann	3737 E. Washington	Probes	3 feet			C24	04-67923	Probes fired at suspect in vehicle; initially effective; suspect removed probes after cycle; then complied	2 misd	
6/21/2004	Goehring	533 W. Washington	Probes	12-15 feet	M/W	36	C29	04-70356	Suicidal subject fled from ambulance; probes effective	PC Conveyance	
6/25/2004	Herrera	303 N. Henry	Drive-Stun	na	M/B	27	C30	04-72053	Drive-stun to resistive suspect; effective	2 misd	
6/29/2004	R. Gonzalez	3500 E. Washington	Probes	12 feet	M/B	31	N18	04-73768	Probes fired at suspect after foot pursuit; effective	1 misd	
7/4/2004	L. Walker	519 E. Johnson	Probes	10 feet	M/B	41	C30	04-76494	Suspect actively fighting another individual; probes effective	1 misd	
7/8/2004	Wiering	4833 Sheboygan	Probes	4 feet	M/B	38	W14	04-78141	Noncompliant suspect after 10-80; OC ineffective; probes effective	4 misd; 1 felony	
7/13/2004	Patterson	State & Johnson	Probes	5 feet	M/B	22	C28	04-80878	Noncompliant suspect after foot pursuit; 2 cycles; very effective	1 misd; P&P	
7/31/2004	Trijke	4501 Verona Rd	Probes	8 feet	M/B	33	W9	04-88794	Retail theft suspect in foot pursuit; probes effective	2 misd	
8/3/2004	McConnell	2914 Industrial Dr.	Drive-Stun	na	M/W	42	C21	04-90076	Suspect actively resisting in squad at detox, kicking at officers; drive-stun marginally effective	2 misd; 1 felony, P&P	
8/10/2004	B. Gonzalez	North & E. Wash	Probes	6 feet	M/W	22	N15	04-93275	Suspect attempting to flee by getting on motorcycle; probes effective	3 misd	
8/14/2004	Tye	2300 Allied Dr.	Probes	10-11 feet	M/B	18		04-94992	Probes deployed at suspect in foot pursuit, one probe missed, ineffective	2 misd	
8/14/2004	Esser	2300 Allied Dr.	Probes	10-11 feet			S6	04-94992	Probes deployed at suspect in foot pursuit; ineffective; appears clothing was cause		
8/22/2004	B. Gonzalez	2229 Superior St.	Drive-Stun	na	M/B	33	N32	04-98526	Arrested person violently resisting, two drive-stuns effective	2 misd	
8/23/04	Dunnington	600 W. Badger	Probes	5-6 feet	M/W	21	S4	04-99207	Uncooperative subject, probes initially effective, then failure (poss. Weapon defect)	1 misd	
8/23/04	Green	W. Bellline & Whitney	Drive-Stun	na	M/B	35		04-99187	Resistive subject, several drive-stuns delivered, marginally effective	2 misd	
8/23/04	Frei	125 Crystal Ln	Probes	6 feet	M/W	43	N19	04-99258	Violent suspect after foot pursuit; knee strikes & front kick ineffective; probes effective	3 misd	
8/25/04	Radke	11 N Seventh St.	Drive-Stun	na	M/W	29		04-100153	Suspect resisting after being handcuffed, kicking at officers; drive stun effective	2 misd	

July 2003 - January 2005

Date	Officer	Location	Probes/Stun	Distance	S/R	Age	Taser	Case Number	Comments	Charges	Armed?
8/28/04	McConnell	1980 Atwood Av	Probes	11 feet	M/W	41	C21	04-101720	Suspect fleeing; probes effective; 2 cycles delivered	2 misd	
8/29/04	R. Gonzalez	3737 E. Washington	Drive-Stun	na	M/W	24	N15	04-101264	Suspect physically resisting; probes effective	2 misd; P&P	
8/30/04	McConnell	2914 Industrial Dr.	Drive-Stun	na	M/W	26		04-102185	Suspect physically resisting being put into 4-point restraints at detox; drive-stun effective	2 misd	
9/6/04	Wixom	4825 Lovell La	Probes	4-5 feet	M/A	15		04-105838	Violently resisting suspect; probes effective	3 misd	
9/28/04	Meinert	1701 Blossom Lane	Probes	8-10 feet	F/W	22	C26	04-115932	Suicidal subject w/ knife, probes effective; 2 cycles	PC Conveyance	
10/1/04	Alvarez	Fairchild & W. Wash	Probes	10 feet	M/W	26	C23	04-117644	Uncooperative subject walking away from officer; probes effective	2 misd	Yes
10/6/04	Wiering	2349 Allied	Probes	1-3 feet	F/B	31	W14	04-119488	Violent female, probes effective	1 misd; 1 felony; P&P	
10/9/04	L. Schwartz	2001 Sundstrom	Probes	3 feet	M/B	15		04-120869	Violent juvenile, probes deployed w/minimal effectiveness followed by drive-stun; clothing failure	2 misd	
10/10/04	Heimsness	10 S. Midvale	Probes	7 feet	M/B	21	W13	04-121252	Violent suspect fleeing from traffic stop, struggled w/officers; probes effective	4 misd	
10/12/04	Millon	2009 Melrose	Probes	15 feet	M/W	32	N19	04-122010	Probes fired at suspect, both missed; suspect still complied	1 misd; P&P	
10/30/04	Heimsness	3129 Maple Valley	Probes	10 feet	M/W	22	W12	04-130102	Uncooperative subject, probes effective, 2 cycles	3 misd	
11/4/04	Knight	6813 Schroeder Rd	Probes	4-7 feet	M/B	26	W8	04-132568	Uncooperative subject, only one probe hit; suspect complied	1 misd	
11/6/04	Alvarez	2914 Industrial Dr.	Drive-Stun	na	F/W	35	C28	04-133436	Uncooperative subject at detox, resisting being put into restraints; drive-stun effective	PC Conveyance; P&P	
11/8/04	Morovic	2500 Fish Hatchery Rd	Probes	8-11 feet	M/B	15		04-134317	Fleeing juvenile burglary suspect; probes fired through/over fence; missed	1 misd; 2 felony	
11/16/04	D. Xiong	109 Cottage Grove	Probes	6-8 feet	M/W	29	C26	04-134027	Resistive subject at detox; minimal effectiveness; poss. Low muscle mass or close probe spread	1 misd	
11/13/04	Acre	2914 Industrial Dr.	Drive-Stun	na	M/W	44	W10	04-136484	Uncooperative subject at detox; drive-stun effective	PC Conveyance	
11/24/04	Alvarez	215 S. Bedford	Drive-Stun	na	M/B	44	C29	04-141096	Uncooperative subject struggling w/officers; drive-stun effective	2 misd	
11/27/04	McClurg	2200 W. Broadway	Probes	1-3 feet	M/B	43		04-141653	Violent suspect after short pursuit; not effective; appears one probe missed	3 misd; 3 felony	
12/5/04	R. Finnegan	3400 Hwy 30	Probes	5 feet	M/B	32	C21	04-144792	Violent suspect aggressing on officer; probes effective; 2 cycles	3 misd; 1 felony	
12/8/04	R. Gonzalez	2453 Upham	Drive-Stun	na	M/W	21	N19	04-145638	Resistive suspect; 2 drive-stun cycles delivered; effective	3 misd; P&P	
12/9/04	Armagost	1321 Tompkins	Probes	3 feet	F/W	17	C26	04-146303	Violent female suspect w/knife; probes effective; 2 cycles; very close probe spread	4 misd	Yes
12/11/04	Valenta	712 S. Whitney	Probes	3 feet	M/B	40	W7	04-147143	Resistive suspect exiting squad; probes initially effective, wires likely broke mid-cycle	2 misd; 1 felony	
12/11/04	Nale	712 S. Whitney	Drive-Stun	na			W10	04-147143	Drive-stun attempted during struggle; Taser malfunctioned (no spark)		
12/14/04	Esser	1034 Moorland	Drive-Stun	na	M/W	51		04-147483	Drive-stun to buttocks during struggle; not effective	PC Conveyance	
12/18/04	Shane Olson	4321 Britta Pkwy	Probes	10 feet	M/H	55		04-149783	Suspect believed to be armed w/knife; dual deployment, marginal effectiveness due to heavy coat	5 misd; 1 felony	
12/18/04	Kobinsky	4321 Britta Pkwy	Probes	10-15 feet			W12	04-149783	Suspect believed to be armed w/knife; dual deployment, marginal effectiveness due to heavy coat		
12/21/04	Herrera	117 W. Main St	Probes	5 feet	M/W	34	C31	04-150965	Violent suspect in rear of squad, kicked officers multiple times, probes effective	3 misd; 1 felony	
12/24/04	Rile	1329 Temkin	Probes	5 feet	M/B	33	W11	04-152104	Uncooperative subject w/mental health issues; probes very effective	PC Conveyance	
12/29/04	Leerek	2121 East Springs Dr.	Probes	10 feet	M/W	24	N19	04-153268	Fleeing suspect, probes not effective; clothing	3 misd; 2 warrants	
1/1/05	Paulson	1007 W. Badger	Probes	8-11 feet	M/W	34		05-352	Barricaded subject, poss. Armed, uncooperative, emerged from building, probes very effective	PC/ED	
1/18/05	Reilly	600 S. Thornton	Drive-Stun	na	M/B	31		05-005944	10-80 subject resisting after pursuit; drive-stun moderately effective;	1 misd; 1 felony	
1/21/05	Harder	201 S. Gammon	Probes	21 feet	M/B	14		05-007239	Fleeing Juv. Reaching in pocket, initial recation then continued to flee; probably bottom probe came out	1 misd	
1/21/05	Kobinsky	Gamon/Watts	Probes	3	M/B	28	W12	05-007301	Uncoop. Subject; 1st cycle into lower leg due to coat, initially effective, wire broke during struggle	1 misd	
1/21/05	Kobinsky	Gamon/Watts	Probes	3			W12	05-007301	Reload & 2nd probe deployment to hamstring, effective		

MPD Taser Deployments - Display or Threat Only

April 2004 - January 2005

Date	Officer	Location	Probes/Stun	Distance	Taser	Case Number	Comments
4/16/2004	Grann	500 N. Oak	Laser Only	na	C22	04-40646	After foot pursuit, laser on suspect drew compliance
4/27/2004	Fiore	2914 Industrial	Display Only	na		04-42820	Displayed X26 and threatened use, suspect complied
5/1/2004	Radke	St. Mary's ER	Display Only	na		04-47543	Suspect refused to enter squad, laser displayed, complied
5/6/2004	Leerek	1933 Manley St.	Verbal Threat	na		04-49942	Suspect resisted, ofc. Threatened to use taser, suspect complied
5/15/2004	Radovan	7000 Mineral Point Rd.	Display Only	na		04-53898	Noncompliant suspect after foot pursuit, threatened w/taser, complied
5/27/2004	Wiering	2114 Rosenberry	Display Only	na		04-58918	Suspect refusing to exit vehicle, display effective
5/24/2004	Wiering	2349 Allied	Display Only	na		04-57538	Displayed to disorderly suspects; effective
6/9/2004	J. Dexheimer	Beewick St.	Laser Only	na		04-64992	Uncooperative suspect, laser display effective
6/11/2004	Sweeney	116 W. Washington	Laser Only	na		04-65686	Uncooperative suspect, laser display effective
6/23/2004	Orvis	4202 Milwaukee St.	Display Only	na		04-68689	Uncooperative suspect after pursuit, display effective
6/23/2004	Sweeney	2351 Allied Dr.	Laser Only	na		04-65412	Uncooperative suspect in bedroom; laser display effective
6/21/2004	L. Schwartz	2230 Rosenberry	Laser Only	na		04-70212	Semi-cooperative; laser display effective
7/2/2004	L. Schwartz	2300 Allied	Display Only	na		04-75289	Displayed X26 and threatened use, suspect complied
7/3/2004	Ostrenga	2914 Industrial	Spark Demo	na	S4	04-76143	Uncooperative subject at detox in seclusion room; spark-demo used; subject complied
7/11/2004	Wiering	4219 W. Bellline	Laser Only	na		04-79681	Suicidal subject w/knife; taser display gained compliance
7/18/2004	Sweeney	2914 Industrial	Laser Only	na		04-82475	Uncooperative subject at detox in seclusion room; display & threat; subject complied
7/27/2004	Ostrenga	1905 Beld St.	Laser Only	na		04-87111	Uncooperative subject, laser display effective
7/31/04	Knight	50 Hollywood Dr.	Laser Only	na	W7	04-89080	Uncooperative & intoxicated subject; laser display effective
8/5/04	Fiore	2601 Fish Hatchery Rd	Display Only	na		04-90998	Robbery suspect, complied at sight of laser
8/9/04	Xiong	4017 Claire St.	Laser Only	na	C23	04-93201	Juv. Out of control; laser effective
8/13/04	Wixom	2301 Carling Dr.	Laser Only	na		04-94787	Foot chase suspect hidden in apartment; laser display effective
8/19/04	Favour	1411 Theresa Terr.	Laser Only	na		04-97085	Domestic suspect attempting to flee out widow; display effective
8/20/04	Wiering	4705 Jenewein	Display Only	na		04-97593	Large suspect, noncompliant; taser display gained compliance
8/23/04	Wiering	6300 Betlys Ln	Display Only	na		04-98864	Otc. Responded to fight involving bats, group began to walk away, stopped w/taser display
8/26/04	D. Xiong	141 Langdon	Laser Only	na		04-100245	Robbery suspect fleeing on foot; laser displayed in front of him - suspect stopped
8/26/04	Reilly	141 Langdon	Display Only	na		04-100245	Multiple robbery suspects fleeing on foot, taser displayed - suspects complied
8/27/04	Radke	5236 Piccadilly	Laser Only	na		04-101109	Noncompliant domestic suspect; laser display effective
9/2/04	Sheffer	1738 Roth St.	Laser Only	na		04-103692	Uncooperative & threatening subject; display effective
9/7/04	Jugovich	213 Swanton	Display Only	na	C29	04-106303	Drive stun threatened on noncompliant suspect; effective
9/15/04	Kobinsky	5317 High Crossing Bl	Laser Only	na		04-109758	Uncooperative, threatening suspect; display effective
9/3/04	Wiering	2309 Carling Dr.	Display Only	na		04-104075	Taser threatened at two suspects fighting; one complied, one fled
9/19/04	L. Schwartz	1210 McKenna	Laser Only	na		04-111566	Taser pointed at subject attempting to flee; effective
9/21/04	Kellogg	700 State St.	Laser Only	na		04-112533	Taser use threatened, effective
9/30/04	Krahn	100 N. Broom	Laser Only	na		04-116772	Taser pointed at uncooperative subject; effective
10/18/04	Wiering	5600 Russett	Display Only	na		04-124472	Uncooperative subject on traffic stop; display effective
10/24/04	L. Schwartz	704 Odana	Laser Only	na		04-127293	Domestic suspect hiding in garage; laser effective
10/28/04	Pharo	1619 Troy Dr.	Laser Only	na		04-128829	Juv. With knife, laser effective
10/27/04	Wixom	2422 Allied Dr.	Laser Only	na		04-128710	Uncoop. Subject
11/16/04	Pharo	89 East Towne Mall	Laser Only	na		04-137762	Aggressive Juv. At mall, laser effective
11/22/04	Shane Olson	676 S. Whitney Way	Laser Only	na		04-140280	Uncooperative retail theft suspect; laser effective
11/26/04	Grann	1203 MacArthur	Laser Only	na		04-141388	Escape suspect leaving bldg.; laser effective
12/4/04	Pharo	300 Oak St.	Display Only	na		04-144490	Physically resistive suspect in squad, display effective
12/19/04	Krahn	1209 MacArthur	Display Only	na		04-149988	Taser use threatened during struggle
12/26/04	Bitterman	3301 Cityview Dr.	Laser Only	na		04-152617	Uncooperative subject, laser display effective
1/12/05	D. Dexheimer	1810 Northport	Display Only	na		05-004172	Resisting subject, display effective
1/15/05	Kobinsky	481 Hilton	Display Only	na		05-005165	Resistive subject; display effective
1/25/2005	Patterson	431 W. Main	Laser Only	na		05-008963	Resistive subject; laser effective

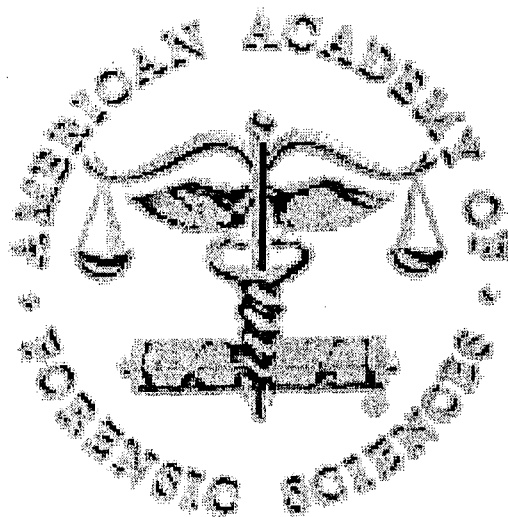
Lethality of Tasers

James Angelo Ruggieri, P.E., MIEE

57th Annual Meeting

New Orleans, LA

February 25, 2005



James Angelo Ruggieri, P.E., MIEE AAFS 57th Annual Meeting, New Orleans, LA

Taser M26

Voltage 50,000 Volts (50 kV)

Peak Current 18 A

Average Current 162.48mA (RMS)

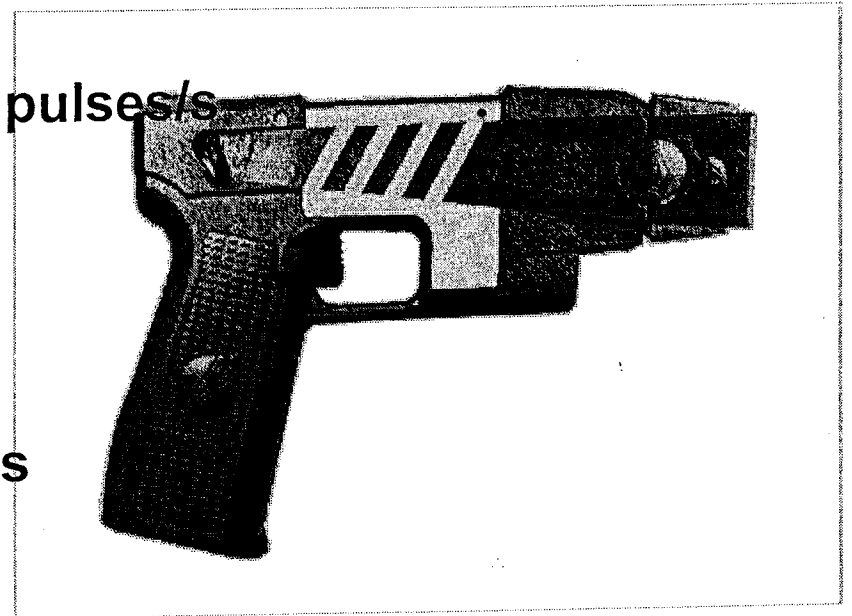
Current Range 100 to 500 mA

Repetition Rate 2 to 40 pulses/s (19)

Pulse width duration 10 μ s to 100 μ s

Output Pulse Energy 1 to 3 J

Body Impedance Reference 1000 Ohms

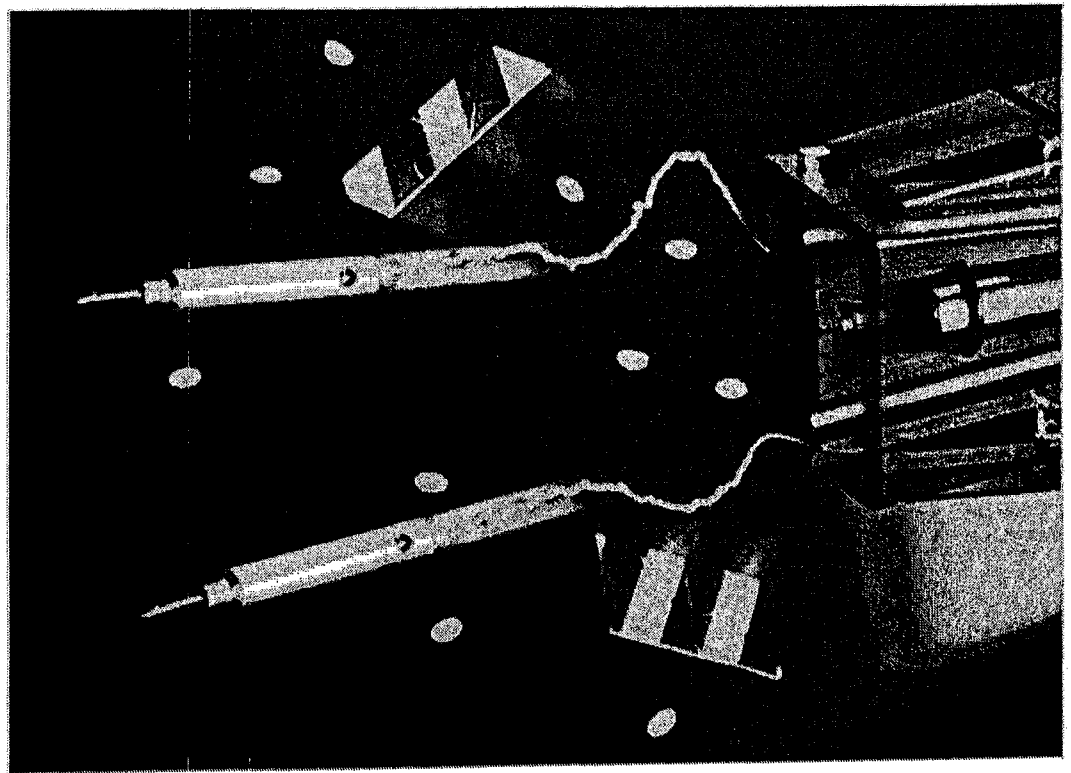


Darts

Fishhook barbs ~6 mm sq. area
~350 FPS

Penetrates up to 2-inches
of clothing (compressible)

Poor accuracy
~2 feet spread at 21 feet



Taser-Related Deaths

- 90 + deaths
- Typical Profile, Most:
 - **About “middle-aged”**
 - **No history of cardiac/medical problems.**
 - **Small amounts of cocaine and/or alcohol in system.**
 - **VF/CA within 45 minutes of Tasing.**

Drive Stun Mode Example

Washington, D.C. Summer 2004

Through T-Shirt, 2nd Degree Burns, Applied 6 times (12 Blisters)

Marginal Effectiveness. No drugs in patient's system

Skin Effect & Faraday Shield

➤ **Stratbucker:** Fetus is protected since Taser high frequency current cannot penetrate into human tissue; Fetus. Fetus, organs cannot be harmed.

➤ **Bleetman:** Uterus/ fetus protected; phenomena “prevents direct conduction into nerves and muscles.”

But then why do all body muscles respond to pulses?

➤ **Others** relied upon/quoted this same assertion in their basis. *Transitive Error?*

(i.e., Valdez v. Farmon, Other Paper Reviewers, Police, Medical etc.)

But ... is this true?

Heaviside's Equation for Skin Effect

$$\sigma = \frac{1}{2\pi f \left(\frac{\mu \varepsilon}{2} \left[\sqrt{1 + \left(\frac{\sigma}{2\pi f \varepsilon} \right)^2} - 1 \right] \right)^{\frac{1}{2}}}$$

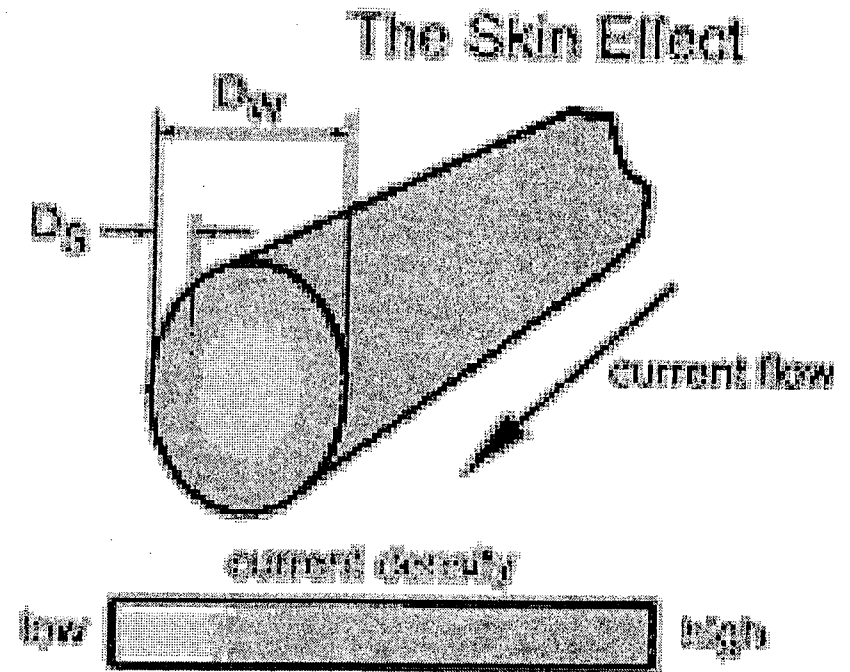
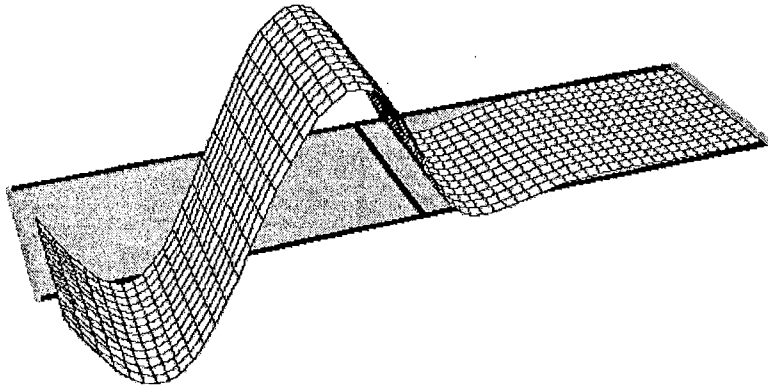
where:

$\mu = \mu_0 \mu_r$ is the magnetic permeability of the material

$\varepsilon = \varepsilon_0 \varepsilon_r$ is the dielectric permittivity of the material

f = is the frequency of the current induced in a material

Skin Effect



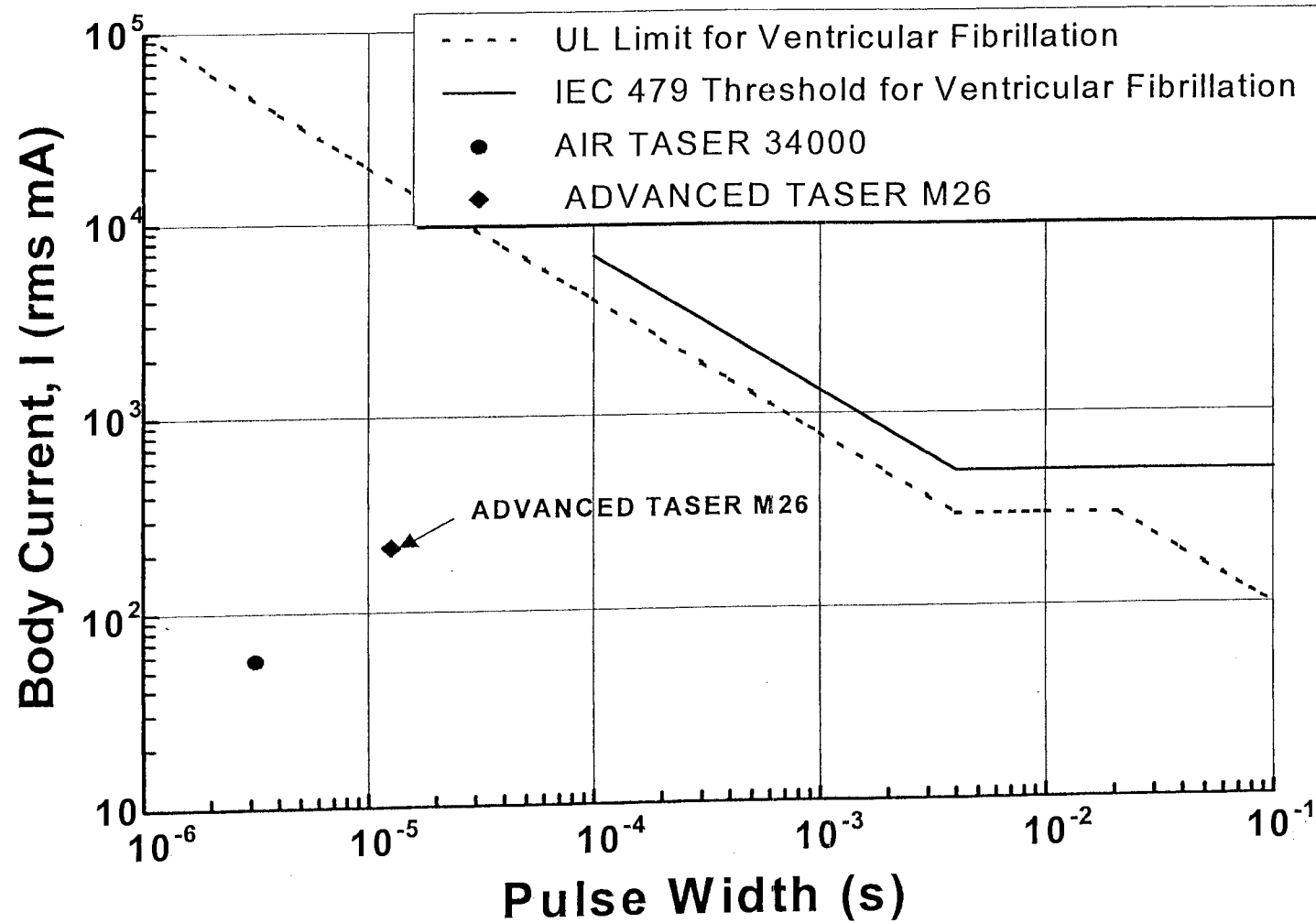
Skin Depth depends on current frequency - It doesn't happen in Bio Materials under 10 MHz. *J.P. Reilly, Applied Bioelectricity*

Taser M26 possible frequencies is 10 KHz to 100 KHz (1/100 to 1/10 μ s)

Taser can penetrate deep into tissue (e.g., heart, fetus, etc.)

Stratbucker/Bleetman never performed tests to test theory.

UL, IEC 479 Standards Taser Marketing Graph



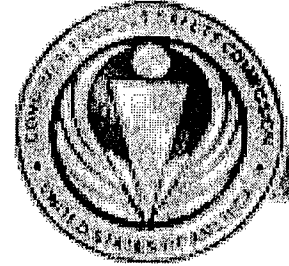
UL 69 - Electric Fences?

Graph contrasts Taser M26 and Taser 34000 current pulse-width plots to UL and IEC 479 limits for VF.

Taser: The UL standard addresses periodic pulse trains and is *“directly applicable to pulse wave devices like the Sticky Shocker.”*

UL: No such standard, UL 69 (Electric Fences) not applicable, UL never tested and never certified any Taser. No UL standards governing “pulse wave devices” *Walter Skuggevig, UL*

UL 69 & CPSC



1976 CPSC Dr. Theodore Bernstein Tests on weaker Taser device:

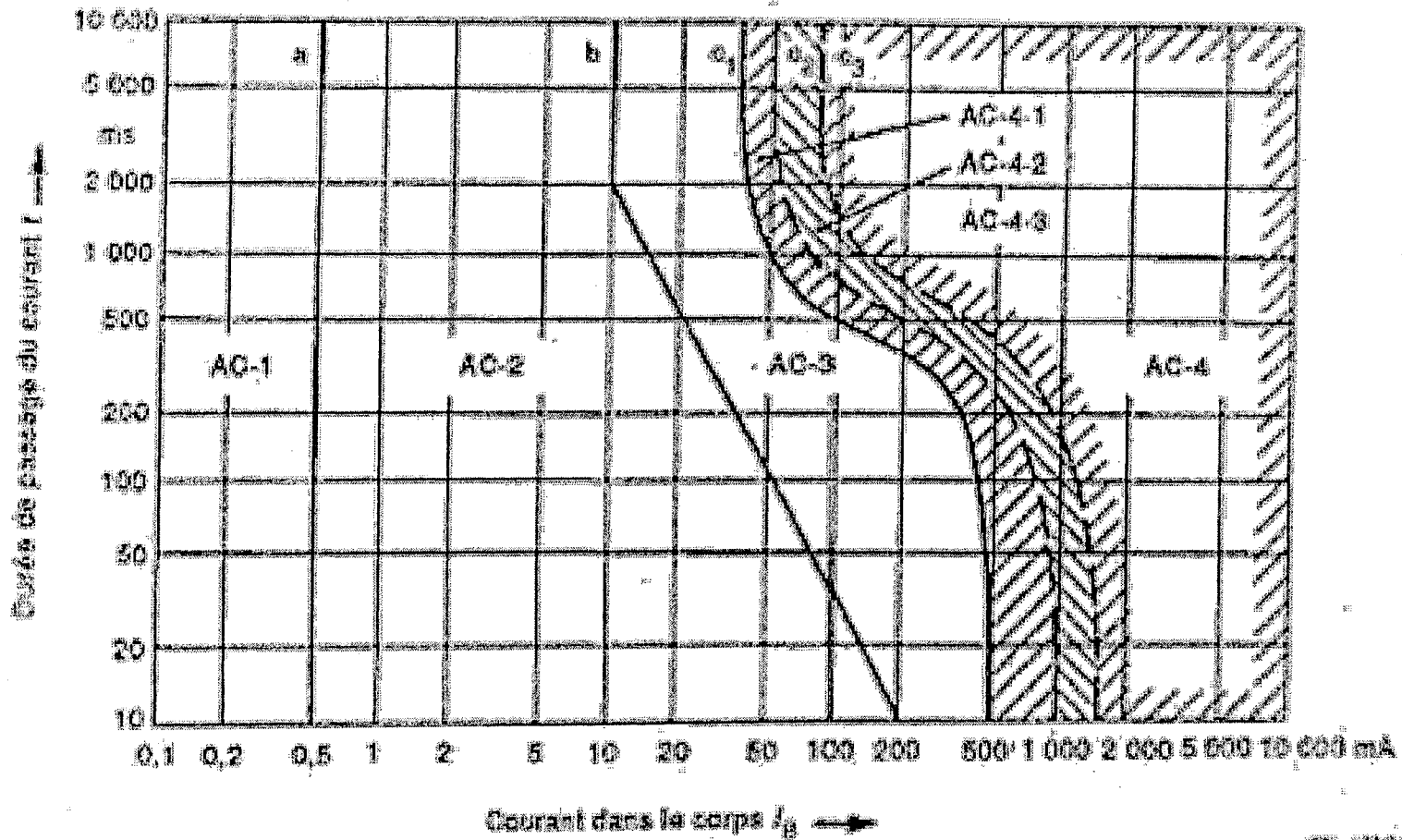
Taser output energy per pulse is somewhat higher than the allowable output for an electric fence.

Taser pulse occurs 13 times per second compared to the once per second for the fence. The power into the load is 13 times greater for the Taser output than for the electric fence. These results indicate that the Taser output is more hazardous than an electric fence output. (M26 = 19 Pulse/s, therefore 19X)

Graph not reproducible

IEC 479 -1

Effects of Current On Humans & Livestock, 50/60 Hz Zone AC4-3, +50% for VF, Hand to Feet, Touch Contact



IEC 479-1

**Taser disputes applicability of IEC 479-1
because of pulse-width differences**

Taser M 26: 10 μ s to 100 μ s

IEC 479-1: 50/60 Hz

Eric Koscove: Lack of experimental data on the clinical effects of a train of damped sinusoidal waves as a function of pulse frequency, pulse duration, amplitude, current and frequency.

J.P. Reilly: Dog experiments – VFT occurs at a peak current of 15 mA +/- 4.3 mA for **single DC pulse of 1 ms duration but ...**

Impact of Repeating Pulses

Reilly & Bernstein: Repeating stimuli causes VF threshold to fall considerably.

Reilly shows the VF threshold to fall by a factor of thirty with six pulse train – that is, VFT drops from 30 mA to 1 mA in six pulses.

“The ability of a stimulus to produce multiple cardiac excitations significantly affects its potency for causing fibrillation.”

Taser M26 up to 40 pulses/sec. (19 p/s *5 sec = 95?)

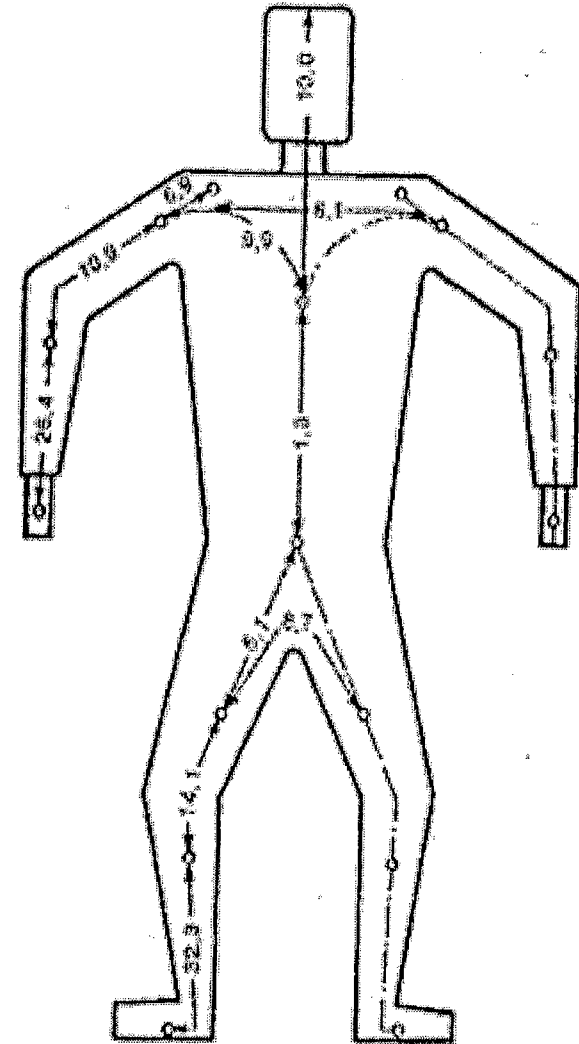
For Taser M26 pulse width = 100 μ s: 10M smaller than 1 ms pulse width used by Reilly in his dog experiment, but Taser M26 I-peak = 18 Amperes, 30M larger than Reilly's 15 mA model.

Body Impedance (*Z Man*)

Taser uses 1000 Ohms Ref.
But 1000 Ohms = Hand to Feet
Across Torso or Back
= 1.3% HF or 13 Ohms (Z-Man)

Bernstein: Entry of fishhook barbs likely incur local trauma, serving to increase the effective area of the barb, and therefore decreasing resistance to a value as low as 200 ohms.

$$I = E / Z$$



Taser Lethality

OZ Roy: “Far from benign” “pump failure and cardiac arrhythmia can occur when stun-gun devices are applied directly to the chest, and pacemaker leads can act as a secondary winding of a transformer.”

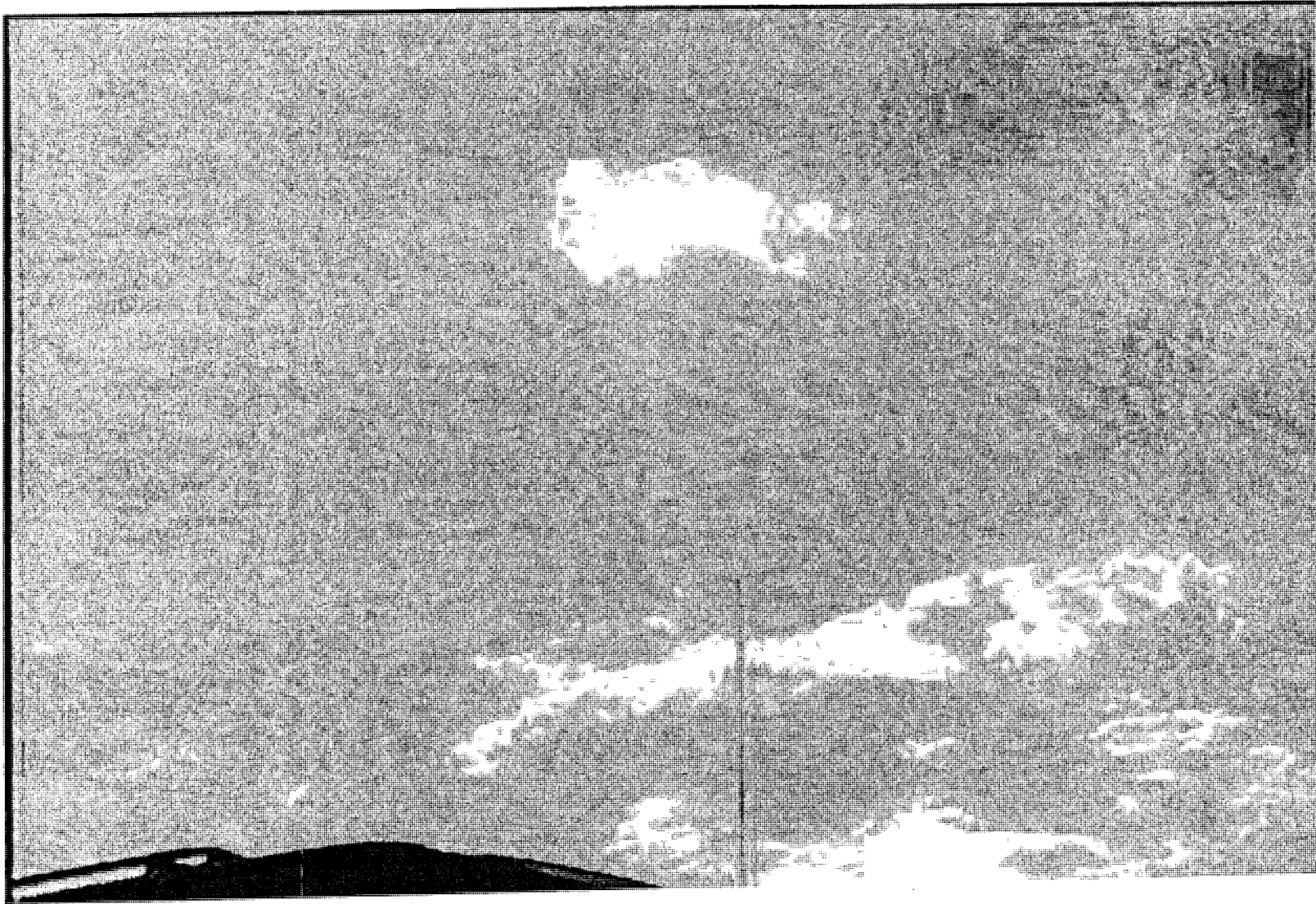
VFT Charge Variation between Taser and Others				
Researcher	Pulse Width	Weight/Pigs	Charge VFT	Multiplier
Roy (Independent)	$\leq 20 \mu s$	~40 and 52 kg	3 μC to 4 μC	Ref.
Kroll (Taser)	$10 \leq 100 \mu s$	~40 and 52 kg	1056 μC to 1440 μC	31 and 42 X

Delayed VF

ME conclusions based on belief that VF would have occurred immediately.

- PJ Jensen: 8 to 12 hour delays in the onset of symptoms for three patients who sustained electric injuries with current passing through the thorax. Jensen described the resulting ventricular arrhythmias as severe and long lasting, and in two of the three patients, ventricular tachycardia or ventricular fibrillation or both occurred.
- Permanent Damage Possible
 - Orme, S, Channer, KS *Tachycardia following low-tension electrocution*,
 - Jensen PJ, et al *Electrical injury causing ventricular arrhythmias*.

Taser: “They would have died anyway”

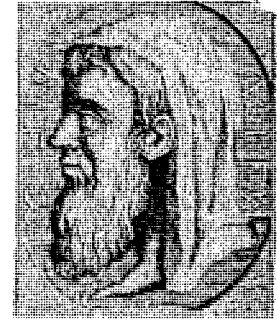


Kroll: *"Taser Safer Than Tylenol"*

Kroll: 18 Grams
(Whole Bottle)
Suicide Attempts



Conclusions



- Used only in circumstances where a failure to act is likely to result in severe injury or death to either the officer, the patient, or to others, and no other force alternative is feasible.
- Police should be informed that the Taser can kill, and judge accordingly.
- Never be used as a routine means to control an unruly individual where other, less lethal means can be effective.

Conclusions, Cont'd



- Special training programs/ response strategies needed.
- Stop exemplar officer *Tasing* as a means of training for authorization.
- Police officers and others who have been *Tased* should seek medical evaluation to determine possibility of injury to the heart.
- Don't target thoracic region.

Conclusions, Cont'd



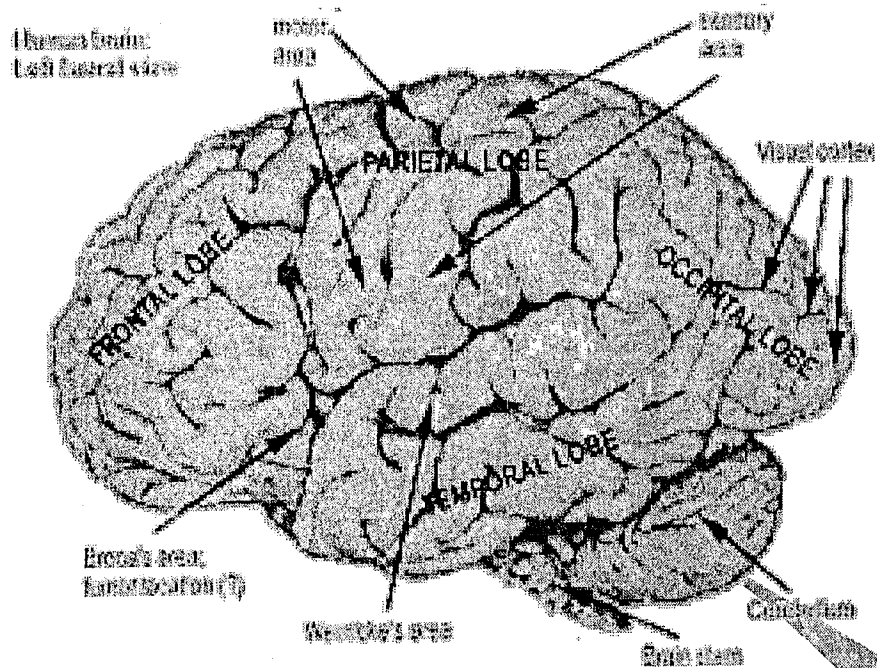
- Tased patients should always receive immediate follow-up evaluation by medical personnel – despite absence of symptoms.

Cooper

- AED devices should be on hand.

Tseng & Kroll

- Public availability - should be subject to the same oversight presently given to other classes of deadly weapons. Need for Federal, State and Local Regs.



Questions?

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March 4, 2005

Sgt Darren Laur
Victoria Police Department
850 Caledonia Ave.
Victoria, British Columbia
Canada, V8T 5J8

Dear Sgt. Laur,

You called me on February 28 to elicit my comments on a presentation that was given at the 57th Annual Meeting of the American Academy of Forensic Sciences. The presenter was James Ruggieri; the title of his presentation was *Lethality of Tasers*. The date of the presentation was February 25, 2005. On March 1 you sent me a copy of his slides, which I have reviewed.

Several of the slides merit comment. To be fair to Mr. Ruggieri, note that I did not hear the actual presentation. Therefore, I cannot be certain of the context in which the slides were given, nor am I aware of questions and answers from the meeting that might have clarified some of the points I wish to raise. Given your deadline (March 4), I must keep my commentary brief. While I provide commentary on a few of the slides in Mr. Ruggieri's presentation, I agree with some of his statements appearing on his other slides.

From the information you provided me in addition to the set of slides, it appears that some inappropriate conclusions have been circulated relative to the information in Mr. Ruggieri's slides. I hope the attached comments will help clarify possible misinterpretations of data applied to Taser safety. If you desire a more detailed discussion of the issues, I recommend the publication by Maier et al. (2004), of which I am a co-author.

Sincerely,

J. Patrick Reilly

Comments on “Lethality of Tasers”, presented by J. A. Ruggieri, Feb. 25, 2005.

1. Page 14, titled “Impact of Repeating Pulses”. This slide contains two statements regarding ventricular fibrillation (VF) that deserve discussion:

(a) “Reilly shows the VF threshold to fall by a factor of thirty with six pulse train – that is, VFT drops from 30 mA to 1 mA in six pulses.”

(b) “The ability of a stimulus to produce multiple cardiac excitations significantly affects its potency for causing fibrillation.”

The statements appear to have been taken from Figure 6.6 and the ensuing discussion in my book, *Applied Bioelectricity*. Although the quotations are accurate, their application to Taser safety requires care. Note that the X26 and M26 Tasers normally produce a sequence of pulses at a rate of 19 per second.

The VF threshold can drop with the number of pulses in a repeated pulse train only if the individual pulses are above the threshold of cardiac excitation, i.e., at Taser repetition rates (19/s), a single pulse must be capable of inducing an extra beat during the diastolic period of the cardiac cycle. Note that an induced extra beat does not in itself constitute a hazardous situation, although VF is usually fatal.

Regardless of the number of pulses, experimental evidence demonstrates that the VF threshold lies above the excitation threshold for stimulation by a single pulse. If the individual pulses in a pulse train are below the excitation threshold, then there can be no excitatory effect on the heart by the full pulse train.

The measured outputs of the M26 and X26 Tasers are well below the calculated threshold of cardiac excitation in healthy humans. Furthermore, laboratory tests have demonstrated that the output of the X26 Taser must be enhanced 15 to 42 times above the normal output to elicit VF in pigs (McDaniel et al, 2005). Since the output of the X26 Taser is more effective than that of the M26, the output enhancement factor for VF by the M26 Taser is expected to be even greater.

In view of these facts, neither the M26 nor X26 Taser is expected to present a VF hazard when applied to the thorax of healthy human adults. I am not aware of scientific investigations of Taser safety in potentially sensitive people (e.g., the ill or under the influence of drugs).

2. Page 15, slide titled “Body Impedance (Z_{man})”. The statement is made that the effective resistance of the Taser barbs, when applied across the torso or back, may be substantially lower than 1000 ohms – the impedance cited in the slide as having been used in Taser International tests. While I do not dispute the accuracy of the statement, test data show that the magnitude of the current applied to a biological subject by a Taser is nearly invariant with respect the subject impedance over a fairly wide range (Taser International, 2005). This property follows from fact that the Taser

output appears as a high-impedance source. Consequently, the lower subject impedance assumed in this slide is not significant.

3. Page 16, slide titled "Taser Lethality". This slide quotes a paper by O.Z Roy, that the stun device is "Far from benign...", and "pump failure and cardiac arrhythmia can occur when stun-gun devices are applied directly to the chest...". Although the slide does not identify a particular paper, I find the quotations in this slide to appear in a paper by Roy and Podgorski (1989).

Drs. Roy and Podgorski tested the cardiac response of two pigs using five different stun guns, with electrodes applied to the surface of the thorax above and below the heart, representing the most sensitive positioning of the electrodes with respect to cardiac stimulation. They were able to elicit cardiac arrhythmias only with the gun having the strongest energy output. From the information provided in the paper, I conclude that the most energetic gun used in these tests exceeded the output of the M26 and X26 Tasers by a large factor. Consequently, from the finding of arrhythmias with that particular stun gun, one cannot conclude that the M26 or X26 Tasers present a cardiac hazard.

The subject slide contains a discrepancy in the Table, where Roy's VF charge threshold is stated to be 3 μC to 4 μC . I do not find these values in Roy's paper. However, similar values are ascribed by Dr. Roy to some of the weaker guns he tested in units of charge density ($\mu\text{C}/\text{cm}^2$), not absolute charge as listed in the table. Although I am not familiar with the paper by Kroll from which data is also listed in the table, I suspect that the tabulated VF threshold data applies to the output charge, rather than charge density within the biological tissue. If this is true, then it would be misleading to compare the Roy and Kroll data directly. I would need to examine the Kroll paper to better assess this comparison.

References

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- A. Maier, P. Nance, P. Price, C. Sherry, and J.P. Reilly (2004). *Human Effects Effectiveness and Risk Characterization of the Electromuscular Disruption Device – TASER, Part I (Report) and Part II (Appendices)*, published by Toxicology Excellence for Risk Assessment (TERA), Cincinnati, OH, May, 2004.
- J.P. Reilly (1998). *Applied Bioelectricity*, Springer, New York.
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February 8, 2005

Dr. J. Cairns
Deputy Chief Coroner for Ontario
Office of the Chief Coroner
26 Grenville Street
Toronto, Ontario
M7A 2G9

Fax 416-314-4030

Re: Opinion on the cardiac safety of the Taser weapon

Dear Dr. Cairns:

Thank you for asking me to evaluate the literature you provided and provide an opinion.

1. Qualifications for providing this opinion:

I hold a Master's degree in Biomedical Engineering, with thesis work and publications focusing on cardiac arrhythmias. I am board-certified by the Royal College of Physicians and Surgeons of Canada as well as the American Board of Pediatrics in Cardiology, with additional training in Cardiac Electrophysiology and certification from the North American Society for Pacing and Electrophysiology for special competency in Cardiac Pacing and Defibrillation. My clinical activity centers on the diagnosis and management of cardiac arrhythmias in children and young adults with normal hearts as well as those with congenital heart disease. I hold staff physician appointments in the Division of Cardiology and the Department of Critical Care at the Hospital for Sick Children in Toronto, as well as Assistant Professor of Pediatrics at the University of Toronto Faculty of Medicine. My CV is available upon request.

2. Summary:

Based on the material reviewed, the TASER device is highly unlikely to provoke cardiac arrest through the induction of ventricular arrhythmias.

3. Rationale:

a. Temporal features related to induction of ventricular arrhythmias.

The time course of deaths reported as being possibly related to TASER use is not typical of the usual clinical picture that experienced cardiac electrophysiologists have observed over several decades of provocative testing for ventricular arrhythmias. During such tests, the ventricle is incrementally paced with progressively shorter extrastimuli until such time as tissue refractoriness is reached, or an arrhythmia is induced. Such experimentally induced arrhythmias are observed as occurring immediately with extrastimuli and there is no known electrophysiologic mechanism to explain any delayed induction of ventricular arrhythmias, whether minutes or hours following the extrastimuli.

Likewise, during provocative testing for the evaluation of implantable cardioverter-defibrillator devices, 60 Hertz current may be directed into the heart as a very potent initiator of ventricular fibrillation. Again, the resulting arrhythmia is observed as an immediate consequence of the stimulus, and late triggering of a ventricular fibrillation minutes or hours later is not a described or electrophysiologically rational entity.

b. Lack of observed arrhythmias during TASER discharge.

The materials supplied include reports of animal and human data demonstrating a lack of induced arrhythmias during standard TASER discharge under continuous electrocardiographic monitoring.

c. Relative safety of a high-frequency discharge waveform.

Ironically, the 60 Hertz AC residential supply current commonly found throughout North America has been shown to be a very efficient means of inducing ventricular arrhythmias at relatively low energy/current loads. Experimental data suggests that the danger of current waveforms drops off dramatically as waveform frequency increases. The TASER weapon waveform is in a similar frequency band to that commonly used in electrocautery devices wherein high frequency current passes from a cautery tip, through the body and is collected at a large ground pad. Because of the high waveform frequency, most of the energy is converted to local heat and very little is available to capture deeper muscle structures unless direct contact is made. A similar methodology ("radiofrequency ablation") is commonly used to cure cardiac arrhythmias, with high-frequency current being applied directly to the endocardial surface of the heart to effectively ablate abnormal areas responsible for arrhythmias. My colleagues and I perform this procedure several times a week within the hearts of children and teenagers and no arrhythmias are induced.

d. Delivery configurations and anticipated trans-cardiac energy delivery.

During intentional medical correction of the cardiac rhythm (cardioversion or defibrillation), large electrode surfaces coated with conductive gel are utilized to minimize the resistance ("impedance") to current flow from the device into the body. As well, great care is taken to ensure that as much myocardial mass as possible is positioned within the discharge pathway between the two electrodes to maximize current and energy flow through the heart during the cardioversion or defibrillation.

In contrast, the typical dart position during a TASER firing is unlikely to maximize the amount of myocardial mass within the discharge vector. As well, TASER darts present a significantly smaller surface area of contact into the body and thus impose a significantly higher impedance. Higher impedance reduces current and energy delivery in fixed voltage/charge systems (like the TASER device); as current and energy (and their relative pathway near the heart) determine the risk of arrhythmia induction, higher delivery impedance reduces risk.

e. Calculated energy delivery and relation to clinical cardioversion and defibrillation.

Typical energy settings for clinical cardioversion defibrillation range from 0.25 to 4 Joules per kg of body weight, translating to a range of 18 to 280 Joules for a 70-kg adult. At 1.76 Joules per pulse, the TASER delivers a subclinical (by a factor of at least 10) dose of electricity in typical subjects, particularly when delivery configuration is taken into account (see d. above).

f. Presence of a large "safety margin" during animal testing.

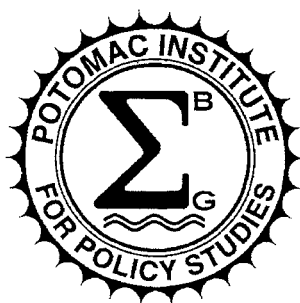
In a series of intentional TASER "overdose" in anesthetized pigs of weights ranging from 66 to 258 pounds, the energy was delivered in a "worst-case" configuration intended to maximize the myocardial mass within the discharge vector (see d. above), with safety margins of at least 15 noted at the smallest sizes, and more typically 30 or better at typical adult body weights. Notable is the use of halothane anesthesia in this series, which is widely regarded as a pro-arrhythmic agent, which may increase the conservative estimates already reported for safety margin.

Sincerely,

Joel A. Kirsh, BAsC, MSc, MD, FRCP(C), FACC
Staff Cardiologist, Hospital for Sick Children
Assistant Professor of Pediatrics, University of Toronto

A POTOMAC INSTITUTE FOR POLICY STUDIES REPORT:
NUMBER 05-04

EFFICACY AND SAFETY OF ELECTRICAL STUN DEVICES



DR. DENNIS K. MCBRIDE
MS. NATALIE B. TEDDER

29 MARCH 2005

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The Potomac Institute for Policy Studies is an independent, 501(c)(3), not-for-profit public policy research institute. The Institute identifies and aggressively shepherds discussion on key science and technology issues facing our society, providing in particular, an academic forum for the study of related policy issues. From these discussions and forums, we develop meaningful science and technology policy options and ensure their implementation at the intersection of business and government.

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We would like to express our deepest gratitude to the members of the Executive Committee who were vital in the planning and execution of this conference. We appreciate their guidance and support throughout this endeavor.

General Al Gray
Dr. Bruno D.V. Marino
Mr. Tom O’Leary
Mr. Ken Stethem

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Executive Summary

On February 23rd and 24th, 2005, The Potomac Institute for Policy Studies in Arlington, Virginia, hosted a two-day conference entitled “Stun Devices: Uncertainties and Gaps in Knowledge.” The conference was co-sponsored by Aegis Industries, Inc. The purpose of the conference was to bring together experts from various fields including medical and health effects, safety and regulatory issues, policy, and industry practices, to discuss what we know about stun device technology and offer insight and suggestions on filling the current gaps in knowledge.

A plenary session was held to discuss the current status of the stun device debate, and the group heard from individuals regarding such issues as current research endeavors, policy concerns, regulations, and the status of the industry. The floor was open to discussion and input was encouraged and received from all members, which was beneficial in making sure all relevant issues were thoroughly addressed.

Conference attendees were then assigned to one of four breakout groups: (1) Policy, led by Dr. Dennis McBride of the Potomac Institute for Policy Studies; (2) Health Effects, led by Dr. Marom Bikson of the City College of New York; (3) Regulatory & Safety, led by VADM Thomas Barrett of the Potomac Institute for Policy Studies; and (4) Industry, led by Mr. Ken Stethem of Aegis Industries, Inc. These groups met with the objective of evaluating issues related to their domain, and developing conclusions and recommendations, which would be presented on Day 2, to all participants who were in the plenary session. The conference ended with a scheduled press conference to summarize the findings and recommendations from each group.

The conference thus served to inform the preparation of this manuscript. The Potomac Institute for Policy Studies is responsible for the information contained within the report. It is important to note that, as in any conference of world-class experts, there was not absolute unanimity on every conclusion reached. The purpose of this report is to objectively evaluate the relative efficacy and safety of stun devices in the context of law enforcement use, and in the near absence of federal governmental attention.

Synopsis of Findings:

- There is no universally accepted terminology or definition for non-lethal weapons in the realm of law enforcement. For our purposes, we adopted the Department of Defense (DoD) definition, and are convinced that this language is appropriate for use by stun device manufacturers and end users. The point of non-lethal technologies is that they are employed with an *intent not* to kill, but to incapacitate temporarily. The public should become educated on this fundamental issue of non-lethal technologies.
- The last and only federal regulatory review of stun device safety was conducted in 1976 by the Consumer Product Safety Commission. The technology evaluated at that time was found not likely to be lethal to normally healthy adults. We have found no report whose purpose was to claim that stun devices are ineffective or unsafe.
- We found a fundamental FDA philosophy to be useful for evaluating the safety and effectiveness of devices such as stun guns. This methodology considers the risks associated with a device *relative to its efficacy*, and considers no product to be completely devoid of risk.

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- There are no federal restrictions or guidelines for stun device use—nor for importation from foreign suppliers for that matter. Moreover, there is no regulating body (private or public) and there are no industry standards.
- Due to the fact that law enforcement agencies are managed at the local level, placement of stun devices on the force continuum may vary amongst organizations. Although some organizations offer exemplary use of force rules, there is no universally agreed upon matching of tactics (use of force) with threatening behavior.

We found direct and indirect evidence specifically regarding the safety and effectiveness of stun technology:

- Indirect Evidence of Efficacy
 - Acquisition of stun devices by law enforcement agencies across the country is increasing substantially.
 - Organizations other than traditional law enforcement agencies have actively voiced support for stun device use as a non-lethal option.
- Direct Evidence of Efficacy
 - Individual law enforcement agency reports offer statistics on situational use and employment results, and a compelling majority of these report favorable success rates, particularly as compared to other techniques and devices.
- Indirect Evidence of Safety
 - Available animal modeling results offer confirming scientific evidence that the employment of stun technology is relatively safe.
- Direct Evidence of Safety
 - Examination of the 72 mortality cases appearing in an Amnesty International 2004 report reveals that in no instance was stun employment singularly indicated or implicated as the specific cause of death, although the application of stun devices could not be ruled out as a possible contributing factor.
 - Analysis of the 72 mortality cases showed that other contributing factors included pre-existing morbidity, such as heart disease; and other significant factors such as excessive drug ingestion, and multiple force applications (e.g., baton + wrestling + stun).

Study Conclusions:

- Based on the available evidence, and on accepted criteria for defining product risk vs. efficacy, we believe that when stun technology is appropriately applied, it is relatively safe and clearly effective. The only known field data that are available suggest that the odds are, at worst, one in one thousand that a stun device would contribute to (and this does not imply “cause”) death. This figure is likely not different than the odds of death when stun devices are not used, but when other multiple force measures are. A more defensible figure is one in one hundred thousand.
- No federal regulative body has asserted oversight of current non-lethal stun technology. As a result, there is insufficient guidance for public and private management. One result of this deficiency is that there are currently no broadly accepted engineering standards in this field.

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We believe that the establishment of industry-driven, government-endorsed standards will contribute significantly to better understanding of this technology domain. We expect better understanding will in turn help shape market (demand and supply) dynamics for products. Competition may also contribute to an increase in the community's self-management of safety issues.

- We strongly recommend that additional research be conducted at the organism, organ, tissue, and cell levels. The mortality figures cited could conceivably reflect inaccuracies in reporting or perhaps there are other factors, such as efficient and effective medical care availability. Moreover, the vast majority of targeted individuals have been relatively young males. The community needs to understand the specific effects of varying electrical wave forms on relevant organic matter of all body types in the immediate time frame of stun application, and in the downstream time course as well, to include possible psychiatric and other non-lethal effects.

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Introduction and Statement of the Problem

We believe there have been well over 100,000 known actuations of electrical stun technology (or merely, stun devices or guns) by law enforcement officers over the last five years.¹ Several police and enforcement organizations confidently claim that the technology is safer and more effective than other non-lethal, and even lethal alternatives. However, there are reports of nearly 100 in-custody deaths that have occurred in association with the employment of stun devices. Although coroners' reports do not specifically indicate that stun employment "caused" death, there is legitimate concern that the significant electrical surge produced by this technology contributed to, or indeed perhaps even caused, death.

Opposition to (or at least critical concern regarding) stun device use is championed by non-government organizations such as the American Civil Liberties Union (ACLU), the Southern Christian Leadership Conference (SCLC), and Amnesty International. The ACLU has called on law enforcement agencies in Rhode Island, Colorado, and California to tighten use of force policies, and to only allow the use of stun devices in situations that present a "true threat" to human life. The SCLC recently held a rally in Pensacola, Florida to launch its national campaign against the use of stun devices, and intends to hold future hearings on stun device use in the State of Georgia. Amnesty International has undertaken the most critical review, and in the process, has done the stakeholder community a tremendous service by documenting the history of this technology, and chronicling episodes of stun employment, particularly in cases with unfortunate outcomes.

Reference to "stakeholder community" above is for our purposes a very important issue. Unlike nearly any other technological domain, there appears to be no U.S. government regulatory organization that has taken "responsibility" for stun device safety. That is, there is no "controlling legal authority" for stun technology regulation. Although the Department of Justice (DOJ) has begun a study on the safety of stun devices, to date, no Federal agency has taken ownership of the issue. The last government assessment of stun safety was conducted by the U.S. Consumer Product Safety Commission (CPSC) in 1976. It found that the product should not be lethal to a normally, healthy person.² Furthermore, the Bureau of Alcohol, Tobacco, Firearms & Explosives (ATF) has not classified the current 'conducted-energy weapon' as a firearm, since this proprietary technology uses compressed nitrogen gas as the propellant. The ATF has therefore offered no restrictions or guidelines for stun device use.³

So, although stun devices are guns, they are not firearms. They have been in commercial use significantly for nearly 30 years and there are unsubstantiated claims that they can kill. The salience of this issue has increased due in part to recent reporting of mortalities in temporal association with police use of stun devices. This study was conducted in order to clarify issues of effectiveness and safety of current stun technology.

¹ The number of stun device actuations is constantly increasing. TASER International estimates the total number of actuations of TASER products only, to be around 200,000. While we acknowledge the continually increasing total, in order to make consistent calculations we will use 100,000 as the actuation figure.

² See May 2, 1985 press release # 85-022 from the Consumer Product Safety Commission. Available at www.cpsc.gov/CPSCPUB/PREREL/prhtml85/85022.html.

³ Interestingly, there are Second Amendment issues associated with stun devices. Anticipated case law here will be very important from a policy perspective.

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Background: Efficacy and Safety of Stun Device Technology

Electrical stun technology has been available and commercially traded for more than a quarter century. The original market, of course, was focused on private purchase in support of personal security. The leading manufacturer of stun devices, TASER International, Inc., reports that it has retailed roughly 100,000 devices for private use, and that approximately 135,000 units have been sold to law enforcement organizations. Sales of the devices indicate clear and growing demand. The TASER-specific units range in cost from around \$400 to upwards of \$1,000 and as a result, retail demand for personal use is arguably dominated by middle-and-upper income individuals and families.⁴

Stun devices are currently used by some 7,000 law enforcement agencies in the United States. However, use of these devices is limited or made unlawful in certain jurisdictions. A summary of legal and policy restrictions is shown in Table 1. It is reasonable to assume that restrictions on, or the criminalization of, stun use are derived from concerns regarding safety, and not from doubts concerning the technology's effectiveness.

Table 1. State & Local Limitations to Stun Device Use⁵

STATES WHERE STUN DEVICES ARE ILLEGAL	
Hawaii	Hawaii State Law. Rev. Stats. Title 10, Chapter 134.
Massachusetts	Massachusetts State Law. Ann. Law of Massachusetts. Chapter 140.
Michigan	The Michigan Penal Code Act 328 of 1931. Chapter 750.224a
New Jersey	New Jersey State Law. New Jersey Stat. Ann. Title 2C. Chapter 39-1. Senate, No. 2871 -- L.1985, c. 360
New York	New York Consolidated Law Book 39. Penal Law. Article 265
Rhode Island	General Laws of Rhode Island. Title 11, Chapter 47. Statute Subsection 11-47-42.
Wisconsin	Wisconsin Sta. Ann. Chapter 393. Chapter 941.295
STATES WHERE STUN DEVICES ARE LEGAL, BUT WITH SOME RESTRICTIONS	
Connecticut	Connecticut Criminal Law Title 53 - Crimes, Title 53a - Penal Code, title 54 Criminal Procedure, Chapter 950 Section 53a-3
Florida	790.001 (15)
Illinois	Identification Card Act. Chapter 720. Criminal Law and Procedure, Article 24. Deadly Weapons.
Indiana	IC 35-47-8
North Carolina	§14-269
North Dakota	North Dakota Century Code Title 62.1 and Article 10-12

⁴There is a "secondary market" within stun device retail, in that consumers can purchase devices at a much lower rate through the Internet. We anticipate that future issues may arise here, after consumers are unable to verify the origin or manufacturer of the device.

⁵ State and city code information available through several retail sites including <http://www.1stlinesecurity.com/stunres.html> and <http://www.beststungun.com/stun-gun-laws.html#den>

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Washington	House Bill 1580, adding new chapter to Title 9 RCW
CITIES WHERE STUN DEVICES ARE ILLEGAL	
Annapolis, MD	Section 11.44.070 Electronic weapons (Ord. O-59-85 § 1: prior code § 17-35)
Baltimore, MD	Baltimore City Code 115. (Ord. 385.1985)
Howard County, MD	Sec. 8.404 (C.B. 38 1985)
District of Columbia	DC Code Ann. Title 6, Chapter 23. Firearms Control.
Philadelphia, PA	Philadelphia City Ordinance. Statute 10-825 Stun Guns.

The use of stun technology by law enforcement agencies has increased significantly over the past five years. Indications of growth include sales figures for the principal supplier, TASER International, Inc. TASER revenue has grown from around \$2.2 million in 1999, to an estimated \$67 million for fiscal year 2004.⁶ In addition, a number of police organizations (and individuals) have specifically and publicly claimed that the technology is very effective, and represents a vital capability in the force repertoire.⁷ Clearly, the devices do represent an option in law enforcement's "force continuum." Whereas stun devices provide a means short of deadly force, they are arguably more effective, and even safer than other elements of the dimension, such as baton use or employment of chemical sprays. Figure 1 shows a graphic of the Canadian Use of Force Model; it provides a representative depiction of the relationship between "force" and the types of "threat" that are encountered by police.⁸ Because law enforcement is regulated by individual states, there is no national use of force model in the United States. However, organizations such as the International Association of Chiefs of Police, exemplar rules of engagement (through the National Law Enforcement Policy Center) for law enforcement agencies on such issues as use of force, electronic control weapons, and other less than lethal weapons.

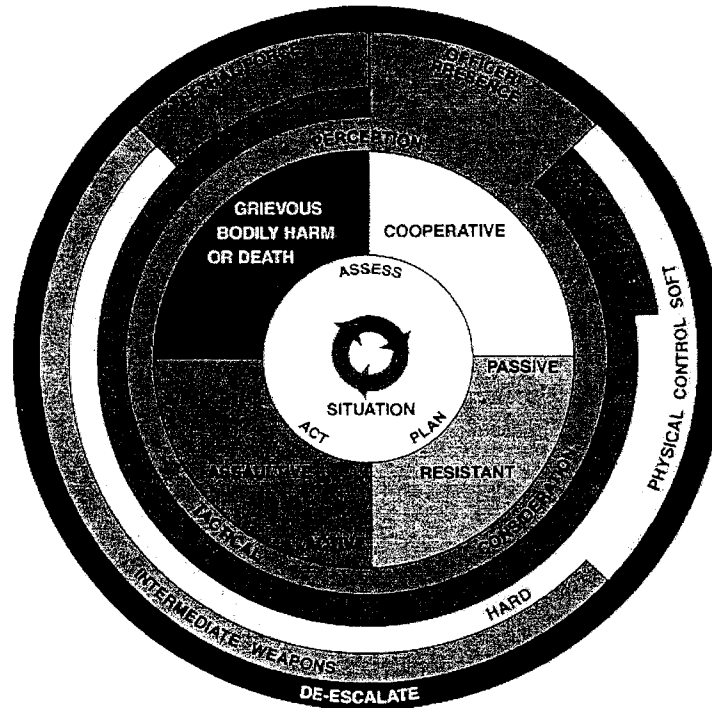
⁶The SEC makes TASER International, Inc. company financial filings available through the EDGAR system at <http://www.sec.gov/edgar/searchedgar/webusers.htm>

⁷ This statement is supported by numerous individual agency reports including those from Chandler, Arizona; Cape Coral, Florida; Madison, Wisconsin; and Orange County, Florida.

⁸ This model is taken from the September 2004 British Columbia Police Complaint Commissioner report on Taser Review. The terms used for Canadian subject behavior levels correspond to the following U.S. resistance level terms: Cooperative/Cooperative; Passive Resistant/Verbal Non-Compliance; Active Resistance/Defensive Resistance; Assaultive/Active Aggression; Grievous Bodily Harm or Death/Deadly Assault.

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Figure 1: Canadian Use of Force Model



Without providing detail here, it is important to note that police organizations develop tactics, and train on selecting context-dependant force options based on perceived levels of aggressive behavior. Police necessarily react to behavior and not intent. A conceptual set of considerations can be inferred from the figure and is confirmed anecdotally by police organizations as follows: (1) the stun option provides a satisfactory alternative relative to the use of deadly force; (2) the stun option does not represent (A) an unsatisfactory alternative to a perhaps less aggressive option and as a result, (B) it does not produce collateral consequences (e.g., death or injury) that would not have resulted with the (claimed) less aggressive option. We must turn to the available evidence to confirm or disconfirm these key claims.⁹

⁹ It is important to note that many states are placing stun devices on the same level of the force continuum as oleoresin capicum(OC) spray (due to ease of subject “after care”), which is lower than impact weapon use and lethal force. Information available at www.policemag.org

Evidence Regarding the Efficacy and Safety of Stun Technology

The two fundamental and obvious technical questions associated with the employment of non-lethal devices in general, and electrical stun technology in particular, are as follow: (1) are they effective, and (2) are they safe? “Safe” and “effective” are of course relative terms, and therefore must be (A) clarified, (B) quantified, and (C) objectively evaluated. Perhaps the largest contribution to confusion over the stun device debate is a lack of precision in terminology. We believe that clarity and universality of definitions is vitally important, and thus we provide the following treatment of terms and concepts.

Non-Lethal Devices Defined. Military forces have long used tactics, techniques and procedures that range from extremely lethal, to those that are considerably less than lethal. Fundamental to this military continuum that is at least as old as Sun Tzu, and typical of today’s military-engineering-legal enterprise, formal definitions have been vetted and adopted in military parlance. We commend the DoD definition of non-lethal weaponry as follows:

“Weapons that are explicitly designed and primarily employed so as to incapacitate personnel or materiel, while minimizing fatalities, permanent injury to personnel, and undesired collateral damage to property and the environment.”¹⁰

The importance of this definition is the emphasis placed on the intent of employment, and not on the unintended outcome of employment. That “force” is used necessarily implies potential harm to tissue or organs, but, at least as military doctrine clearly articulates, the intention of non-lethal technology is not to kill, but rather to incapacitate—and to do so temporarily. Although we know of no similarly published doctrine from law enforcement organizations, we believe that the military definition of non-lethal technology is particularly appropriate in the case of stun devices in law enforcement, and thus we have adopted it for our purposes.

Efficacy (or Effectiveness) and Safety Defined. There are several philosophical models that can be used to frame and subsequently, to define the relative effectiveness—and relative safety of a particular technology. These range from the engineering rigor of military test and evaluation processes, to business-related analyses of product movement to consumers. We chose to follow a conservative Food and Drug Administration (FDA) philosophy for defining efficacy and safety, primarily because of the putative life-and-death matters that have been made central to the stun device debate.

A thematic characteristic of FDA product regulation is the following: efficacy and safety are not examined as mutually independent variables. The fundamental precept of FDA regulation is best portrayed from the source itself: “Although (medical products) are required to be safe, safety does not mean zero risk, since all (medical products) are associated with risks. A safe (medical product) is one that has reasonable risks, given the magnitude of the benefit expected and the

¹⁰ DoD Policy Directive 3000.3, updated November 2003.

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alternatives available,” (U.S.FDA¹¹; The reader may substitute “law enforcement devices” for “medical products”).

No useful technology is perfectly safe. This can be said of *any* technology, even devices that are designed specifically and exclusively to save lives, such as seatbelts or air bags—which themselves can and do kill (to be discussed in relative terms later). The question of efficacy and safety thus decomposes to the following efficacy dominated concerns (A) Does the technology do what it is intended to do at the behavioral level? Does it provide an effective option among force options? Is it an alternative to deadly force, or is it an alternative for other, perhaps less “aggressive” non-lethal tools? Does it incapacitate targeted individuals and targeted individuals only? What is a perpetrator’s perception of the use of this technology vis-à-vis other force options? Safety-oriented interrogatives include: (B) Is the underlying effect (physiologically) understood, and is it reasonable, given the claimed effectiveness? Let us first consider the sources of evidence and then provide an interim assessment.

Table 2 depicts the realm of possible sources of evidence that are considered presently. Information available includes directly applicable data from field experience, and indirectly applicable data from laboratory research and other more or less formal studies. We were not convinced that all of the questions outlined in the former paragraph could be answered with confidence at this time. We have concentrated on the two principal issues: efficacy and safety.

Table 2: Currently Available Evidence Sources

	DIRECT	INDIRECT
Effectiveness	Anecdotal Reports Law Enforcement Agencies	Sales to Police Departments Non Law Enforcement Activity
Safety	Medical Reports Volunteer Episodes	Laboratory Studies Modeling & Simulation

Direct Evidence of Effectiveness. Direct evidence of effectiveness derives from police reports. These are almost invariably positive. The difficulty here is that critics may reasonably argue that police organizations have a bias in favor of stun devices, and that this bias contaminates any self-report of effectiveness. However, we believe that this is blindly dismissive of law enforcement reporting. Summaries from various law enforcement agencies show a consistent pattern of contexts, and of outcomes of use. The Los Angeles Sheriff’s Department, for example, claims a 94 percent effectiveness rate for stun devices. This compares very favorably with success from other techniques and devices such as pepper spray. The latter is believed to provide no better than an 85 percent effectiveness rating. We know of no evidence of targeting, accuracy, or reliability issues that might compromise the effectiveness of stun technology.

¹¹ U.S. FDA Report (May 1999) *Managing the Risks from Medical Product Use. Part 1: Background – What are the Risks and What is FDA’s Role in Managing Risk?*. The reader may substitute “law enforcement devices” for “medical products”.

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Indirect Evidence of Effectiveness. Indirect evidence for efficacy derives primarily from the fact that purchases by law enforcement agencies continue to increase. Based on the assumption that local and state governments make budget decisions in a competitive, vetted, and publicly accountable way, the simple observation that purchases (and repeat customership) continue to increase is an indirect but strong suggestion that the devices are doing what they are purchased to do.

Indirect evidence also arises from the fact that enterprises other than traditional law enforcement agencies, as well as foreign governments such as the U.K., France, and Finland are utilizing this technology. Other support can be inferred from recent decisions by the Department of Homeland Security (DHS) and Transportation Safety Administration (TSA), which now approves the deployment and use of stun devices by specially trained personnel on board commercial aircraft. A 2004 USA Today article noted that stun devices are the only non-lethal weapon that could be used safely on airline flights.¹² Groups such as the Airline Pilots' Association (ALPA) believe that these devices can be valuable for cabin security. Currently, flight attendants are not permitted to carry firearms, therefore the stun device creates an option for securing and protecting the aircraft and its passengers. The Association of Flight Attendants supports this policy, although currently no domestic airline carrier has deployed stun devices on their aircraft. It should be noted, however, that several foreign carriers are using this technology on international flights.

Direct Evidence of Safety. The most direct evidence of safety for stun technology derives from examination of post deployment, or use reports. The range of outcomes available here varies from incidents of in custody mortality, to episodes in which no apparent medical sequelae obtain at all (i.e., no morbidity). Amnesty International has produced an annotated tabularization of the 72 mortality cases known at the time of its publication.¹³ Examination of each case reveals that in no instance was stun employment singularly indicated or implicated as the cause of death. On the other hand, causes of death normally address vital organ (brain) function or cessation; thus stun device employment to the body would not ordinarily be listed as a cause, per se, but rather as a possible contributing factor. Records of the mortality events reveal other consistent and significant patterns, to which we turn next.

The average age of those who died was 36.5, and all but one were apparently male.¹⁴ Depending on the criteria used, 25 to 33 individuals died as the result of drug overdose, as specifically indicated by Coroner or Medical Examiner reports.¹⁵ This included over-dosages of cocaine (19 to 26 cases) and methamphetamine (6 to 7 cases). The level of detail in the documentation shows that unequivocal, multiple use of force was evident in 44 cases. If we subtract the cases in which handcuffing was used without clear indication of significant force, 40 cases

¹² Levin, A. and Woodyard, C. (2004, November 08). "Stun Guns OK'd for use on airline". *USAToday*, p. 1A. Retrieved March 1, 2005 from http://www.usatoday.com/printedition/news/20041108/1a_bottomstrip08_dom.art.htm

¹³ See Appendix A of Amnesty International. (November 2004). United States of America: Excessive and lethal force? Amnesty International's concerns about deaths and ill-treatment involving police use of tasers. Retrieved February 11, 2005, from <https://web.amnesty.org/library/index/ENGAMR511392004>

¹⁴ This inference is based on the first names of the deceased. The single female was actually a fetus.

¹⁵ There is inconsistency based on reporting standards across jurisdictions. We report the most conservative calculations based on scrutiny of the Amnesty International compilation.

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required multiple use of force. There is only one case in which only stun use was applied (see below for details). These multiple force cases included forceful restraint (often requiring several officers wrestling the individual to restraint, “hog-tying,” sometimes to a position that compromised breathing), baton use, chemical spray application, and stun use. There were 14 double-use (e.g., baton and stun) incidents, 24 triple use events, and 6 cases in which 4 or more types of force were employed. The modal application (based on unequivocal reporting) was three forms of force (mean = 2.8; median = 3). This indicates of course that no single application of force used (restraint, stun, etc.) can be singularly identified as the leading element among the “cause of death” contributors. The number of stun applications per individual ranged from 1 to 13 (the latter figure is an outlier—the range otherwise was 1 to 6 stun applications). Median and modal stun application were approximately 2 applications per individual (though the mean = 3.57 due partly to the outlier). From the annotation, it does not appear that any death occurred during or immediately after stun application¹⁶.

Following is a synopsis of the six accounts in which stun application was specifically cited as a salient contributor to death. Average age for these individuals was approximately 39, and use of force was multiple in all cases. Significant heart disease was specifically cited in two cases, and drug overdose (or failure to take prescription medication) was evident in all but one case. The single case in which stun application was the only force used in a death-related case was for an individual who fell, presumably as the result of loss of postural control, and sustained a fatal injury to the head—i.e., before law enforcement officials were able to access the individual. Thus, from Amnesty’s compilation, we are able to confidently isolate stun device application as the principal contributor to death in one instance, and this was due to secondary means (by falling). The pattern almost invariably associated with deaths wherein drugs were involved, and in which stun and other devices were employed, appears to be that of nearly super-human physical struggle, principally against law enforcement officials. A nascent but increasingly respected medical interest in the associated medical trauma is converging on a constellation of symptoms that are being termed “excited delirium syndrome.”¹⁷ Here, in theory, “patients” “out-run” their aerobic reserve and expire, either through fibrillation or otherwise. A key point should be made here: excited delirium syndrome implies mortality caused by multiple factors over-driving the cardiovascular-pulmonary system, and not heart failure produced through electrical surge (from a stun device) applied to or conducted to the heart.

Death associated with in-custody episodes in which stun devices were *not* used also occur, of course. Civilians Down, an advocacy and support group for families who have lost loved ones while in police custody, report that nearly 1,000 people die in police custody each year.¹⁸ This sets up an important hypothesis relative to the isolated contribution of stun devices to in custody demise. If stun devices are “the cause,” and not merely a contributing factor, then there should be significantly more deaths after or during in custody stun-use evolutions than for other (e.g., chemical spray or

¹⁶ This finding is important in light of the fact that when electric defibrillation devices are applied in order to purposefully change heart rhythmicity, the effect is immediate. It is also important to note that defibrillation devices are applied proximal to the heart, surge to 60 Amperes, and do not cause heart attacks, but rather reverse them.

¹⁷ Excited Delirium Syndrome or Acute Exhaustive Mania were cited as cause of death in several of the Amnesty International compilation cases.

¹⁸ Information is available at www.civiliansdown.com.

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baton use) episodes in which stun devices specifically were not used. The evidence here favors the conclusion that stun devices cannot be isolated as the sole, or even a principal cause of death.¹⁹

In summary of the cases cited to date, if we consider the incidents in which stun technology contributed (singularly or in combination) to death, the range is from 1 to 72 mortalities. If we also accept that the applications of stun devices (for demonstration, or for effect) range from 60,000²⁰ to 100,000, the probability of death being associated with stun application ranges from 1 (specific death) in 100,000 (custodial + demonstration uses); to a maximum of 72 (temporally-associated deaths) in 60,000 (custodial uses²¹). This means that a safety factor for stun application is on the order of 0.999 to 0.99999. Stated another way, the probability of death after stun device administration to the body is from one in a thousand to one in one hundred thousand. Looked at from a different probability perspective, the likelihood of death due specifically to air bag deployment in modern automobiles is such that for every 50 individuals saved, one is killed.²² One stun device manufacturer claims that stun devices have saved some 7,000 lives. If true, the most conservative saved/killed ratio for stun devices is 70:1. Based on the data cited above, this number is more likely 700:1 or greater.

A second set of direct data derives from an informal assessment of approximately 40,000 employments of stun devices applied to volunteer law enforcement officers. This process serves the purpose of teaching police the effects of the electrical surge from a personal involvement level, and it thereby presumably inspires some increment of wisdom before the device is used on private citizens. We have found no evidence of mortality or morbidity when police are voluntarily stunned. A legitimate argument here is that this is a faulty sample set because the vast majority of police officers are healthy young males with no exotic drugs in their systems. On the surface, this is a fair criticism. However, in reality, the vast majority of those who have been incapacitated by stun devices were themselves young males. Indeed the Amnesty International compilation cited above included nearly exclusively male (average age, mid-thirties) targets.²³

Indirect Evidence of Safety. The best available indirect evidence of stun device safety comes from modeling efforts, either *in vitro*, *in vivo* (with live animal models), or *in silico* (modeling and simulation). The quantity of information available is not formidable, but the quality of the

¹⁹ As one example, a March 1994 report derived from data collected by the International Association of Chiefs of Police (IACP) states: "A total of 30 incidents were found between August of 1990 and December of 1993 in which the death of a subject occurred following a spraying with OC. The 30 cases, all involving male decedents, share several commonalities. All subjects behaved in a combative and/or bizarre manner and struggled with the police. Drugs and/ or alcohol were involved in most cases. In the majority of cases, OC spray was either ineffective or less than totally effective. Generally, restraint techniques were employed subsequent to spraying, and with one exception, all deaths occurred either immediately or soon after the confrontation." The full report can be found at: http://www.zarc.com/english/other_sprays/reports/iacp_oc_death_1994.html.

²⁰ See next paragraph.

²¹ We are obviously using disparate data sets for numerator and denominator here in order to derive a worst-case estimate for possible stun device lethality.

²² This conclusion is based on National Highway Transportation Safety Board data reporting that from 1990 through 2004 there were 253 confirmed, and 22 unconfirmed airbag related fatalities. The same NTSB data estimates that airbags have saved a gross number of between 13,385 and 16,537 drivers, and 3,152 front-right side passengers. <http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/TextVer/Anchor-SC-29958>

²³ Without elaboration here, one reason that being relatively young and male is partly inoculative is that the skin, musculature, etc., are more voluminous and thus arguably provide more resistance (ohms) and thus more protection for the heart.

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evidence is instructive. We will provide a very brief overview. In fact, we will concentrate on one recent government study.

A recent experimental examination of stun efficacy and health effects was conducted at the U.S. Air Force Research Laboratory. A briefing of the study is available from the Air Force as U.S. Air Force Research Laboratory Technical Report AFRL-HE-BR-TR-2004-0094, September 2004. Dissemination is controlled by DoD Directive 5230.25. The report does not appear in the peer-reviewed literature at this time, however the information in the available briefing is clear. The effort specifically examined the effectiveness (muscle contraction) and cardiac safety (ventricular fibrillation) of stun device application (representing the dose characteristics of a TASER International X-26 product) to swine. The technical community believes this animal to be the best model (due to heart-to-body ratio, etc.) for this type of research.

First, with regard to effectiveness outcomes, it is clear that the stun devices succeeded in causing muscle contraction in the limbs and in producing loss of posture. So at the behavioral and physiological level, evidence of effectiveness seems unequivocal. There is nothing surprising here—this is consistent with reports from law enforcement evolutions with humans, at least at the behavioral level.

With regard to health effects, there were no reported mortalities—no pigs died as the result of stun exposure. In order to understand more fully the physiology of *potential* damage to the body, chemical blood substances known or thought to be associated with muscle damage were collected. In summary, blood pH became more acidic, but returned to normal within an hour of exposure; lactate increased and slowly returned to normal; blood CO₂ increased after application but returned to normal within one hour; serum potassium increased, but returned to about six percent of normal within one hour. Although recommending further study, in summary here, the government reported no evidence of heart attack, nor evidence of enduring, down stream effects based on lagging indicators in blood plasma chemistry.

It is very important to underscore the importance of the dosage levels used in this experiment. Electrical pulses were applied to the animals for 5 seconds, each followed by a period of 5 seconds of no exposure. This on-off pattern was repeated continuously for 3 minutes. At the conclusion of this 180-second mode, a one-hour delay was imposed, and the same treatment was applied for another three minutes to each animal. Thus at six exposures per minute, the porcine models received 18 stuns per period, and thus 36 stun dosages, total. Recall that in the Amnesty International compilation of human mortalities, the average number of stuns was reported to be less than five (in fact mode = 2; mean = 3.57). That is, the pigs in the Air Force study received an order of magnitude more stuns than did the humans in the Amnesty International database. This experimental dosage appropriately minimizes the odds of making an inferential error: That no pig died or showed evidence of sustained (plasma substance) morbidity—despite the very high dosage levels—supports a claim of (relative) safety for the stun device, at least as used under experimental control conditions (e.g., placement of terminals on the animal, etc.).

Conclusions

Based on the available evidence, and on accepted criteria for defining product risk vs. efficacy, we believe that when stun technology is appropriately applied, it is relatively safe and clearly effective. The only known field data that are available suggest that the odds are, at worst, one in one thousand that a stun device would contribute to (and this does not imply “cause”) death. This figure is likely not different than the odds of death when stun devices are not used, but when other multiple force measures are. A more defensible figure is one in one hundred thousand.

No federal regulatory body has asserted oversight of current non-lethal stun technology. As a result, there is insufficient guidance for public and private management. One result of this deficiency is that there are currently no broadly accepted engineering standards in this field. We believe that the establishment of industry-driven, government-endorsed standards will contribute significantly to better understanding of this technology domain. We expect better understanding will in turn help shape market (demand and supply) dynamics for products. Competition may also contribute to an increase in the community’s self-management of safety issues.

We strongly recommend that additional research be conducted at the organism, organ, tissue, and cell levels. The mortality figures cited could conceivably reflect inaccuracies in reporting or perhaps there are other factors, such as efficient and effective medical care availability. Moreover, the vast majority of targeted individuals have been relatively young males. The community needs to understand the specific effects of varying electrical wave forms on relevant organic matter of all body types in the immediate time frame of stun application, and in the downstream time course as well, to include possible psychiatric and other non-lethal effects.

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Academic Emergency Medicine Volume 12, Number 5 suppl 1 71,
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EMS-RESUSCITATION/ADVANCED CARDIAC LIFE SUPPORT

Cardiac Monitoring of Subjects Exposed to the Taser

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ABSTRACT

Background: The Taser is a weapon that delivers high-voltage electricity and is used by approximately one third of U.S. law enforcement agencies. Although generally regarded as safe, little research exists in the literature despite reported sudden deaths. To our knowledge, no prospective human studies on the Taser exist. **Objectives:** To evaluate for cardiac changes utilizing monitoring during deployment of the Taser on healthy volunteers. **Methods:** This prospective, interventional pilot study was performed with police officers receiving training on the Taser X-26. The officers, all of whom had already volunteered to be "tasered," had continuous 3-lead electrocardiographic (ECG) monitoring immediately before, during, and after firing of the Taser. The mean duration of ECG tracing after shock was 16.3 seconds. Primary endpoints included development of changes in cardiac rate and rhythm, morphology, and intervals. Investigators individually analyzed the tracings. Comparative statistical analysis utilized paired Student's t-test and 95% confidence intervals (CIs). **Results:** Data were collected on 20 subjects. The mean shock duration was 2.4 seconds (range 1.2–5 s). Other than sinus tachycardia, no dysrhythmias were identified after the taserings. There was no change in morphology, QRS duration (range 40–80 msec), or QT interval (range 200–400 msec) between the before- and after-Taser groups. After the taserings, there was a 12-msec decrease (95% CI 6 to 18, $p < 0.001$) in the mean PR interval from 132 to 120 msec. The mean heart rates before and after being tasered were, respectively, 127 (range 80–160) and 142 (range 108–175). The mean increase in heart rate was 15 beats/min (95% CI 7 to 22; $p < 0.001$). **Conclusions:** In this pilot study we found no significant cardiac dysrhythmias in healthy human subjects immediately after receiving a Taser shock. In addition, there were no morphologic, rhythm, or interval changes other than a small decrease in PR interval and an increase in heart rate.

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