

**IN THE MATTER OF THE THOMAS R. BRAIDWOOD, Q.C.,
COMMISSIONS OF INQUIRY UNDER THE *PUBLIC INQUIRY ACT*,
SBC 2007, c. 9**

Cypress Room
Residence Inn by Marriott Vancouver
1234 Hornby Street
Vancouver, B.C.

May 9, 2008

PROCEEDINGS AT
FORUM (DAY 5)

ORIGINAL

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Commissioner:	T.R. Braidwood, Q.C.
Commission Counsel:	A. Vertlieb, Q.C.
Associate Commission Counsel:	P. McGowan
Court Recorder:	P. Kealy, C.V.R., C.M.
Transcriber:	P. Kealy

1
Dr. Zian Tseng (Medical presenter)
Questions by Mr. Vertlieb

2 Vancouver, B.C.
3 May 9, 2008

4 THE COMMISSIONER: Good morning, everyone. I
5 understand we're ready to go. Yes, counsel.
6 MR. VERTLIEB: Thank you, Mr. Commissioner. The first
7 presenter, Mr. Commissioner, is Dr. Zian Tseng.
8 And just to spell that, it's Z-I-A-N, and the last
9 name Tseng, T-S-E-N-G.

10
11 DR. ZIAN TSENG, a Medical
12 presenter.

13
14 Dr. Tseng, thank you so much for coming here
15 from your home in San Francisco. Let's explore a
16 bit of your background for the Commissioner.

17
18 QUESTIONS BY MR. VERTLIEB:

19
20 Q Tell us where your first university degree is
21 from.
22 A I have a bachelor's degree in biochemistry from
23 the University of California, Berkeley.
24 Q And what year did you obtain the Berkeley degree?
25 A 1993.
26 Q And following the bachelor's degree, what did you
27 do?
28 A I entered an MD/PhD program at University of
29 California, San Francisco, and I did one year of
30 PhD research and received my medical degree in
31 1998.

32 THE COMMISSIONER: Could you tell me what those
33 initials mean.

34 A The MD?

35 THE COMMISSIONER: You said MD --

36 A MD/PhD, a combined medical and PhD degree program.

37 THE COMMISSIONER: Thank you.

38 MR. VERTLIEB:

39 Q And so the MD was in 1998, Doctor of Medicine.
40 And after you obtained your Doctor of Medicine,
41 what did you do?

42 A I did a residency in internal medicine at the
43 University of California, San Francisco, between
44 1998 and 2000. And then I entered a cardiology
45 fellowship at the same institution between 2000
46 and 2002. Following that I did a second
47 fellowship in cardiac electrophysiology between

1 2002 and 2004. And in 2004 I joined the faculty
2 of the University of California, San Francisco, as
3 a cardiac electrophysiologist.
4 Q We'll come to what type of work that involves in a
5 minute. In terms of being licensed to practise
6 medicine, when were you first licensed to practise
7 as a physician?
8 A 1999.
9 Q And that's in the state of California?
10 A Correct.
11 Q And you've been licensed to practise and are
12 practising since that time?
13 A Correct.
14 Q Even today are you seeing patients in an actual
15 doctor-patient way?
16 A I split my time between teaching medical students,
17 performing my research, and operating. And
18 yesterday before flying here, I performed an
19 operation just before coming. So I still am
20 actively seeing patients.
21 THE COMMISSIONER: What is the nature of these
22 operations, sir?
23 A My work, I deal with treating cardiac arrhythmias.
24 Either the heart rhythm is too fast or too slow,
25 in which case I may implant pacemakers or
26 defibrillators, or I can actually go inside the
27 heart with a catheter procedure and ablate and
28 cure arrhythmias.
29 MR. VERTLIEB:
30 Q Since we've come to that, tell us about that work.
31 How do you do that? What type of patient are you
32 seeing, and then what are you actually doing when
33 you're treating these people? Tell the
34 Commissioner.
35 A So I may see patients typically in a consultative
36 fashion, so I'm a subspecialist and cardiologists
37 will refer patients to me with advanced arrhythmia
38 problems. And then after collecting all the data,
39 I may decide to either follow them or institute
40 medications or perform an operation like
41 implanting a device or ablating an arrhythmia.
42 Q So what is an arrhythmia?
43 A An arrhythmia is a simple term for anything other
44 than the normal cardiac rhythm, which is important
45 for normal cardiac function. I think a simple way
46 to put it is if your heartbeat is too slow, that
47 won't sustain cardiac output for life. If it's

1 too fast, it also will not sustain cardiac output
2 for life. And there are curative procedures that
3 we can do for both of those conditions.
4 Q Give an example of the types of curative
5 procedures you're doing.
6 A So for example, if a patient comes in having
7 fainted or passed out or having had a cardiac
8 arrest from too slow a heartbeat, we can implant
9 pacemakers to regulate the heartbeat and to
10 sustain normal heartbeat. If a patient has a
11 propensity for dangerous, fast arrhythmias such as
12 ventricular fibrillation or ventricular
13 tachycardia, which I will be describing in my
14 presentation, then I can implant a defibrillator
15 which serves to shock a patient back into normal
16 rhythm. There are also certain specific
17 arrhythmias which electrophysiologists can cure
18 with a catheter procedure without implanting a
19 device. So we go inside the heart with a
20 catheter, and from the inside we map the
21 electrical system of the heart and find the
22 abnormal spot of the heart that's causing the
23 dangerous arrhythmia and essentially zap it with
24 radiofrequency energy, killing that one focused
25 spot of the heart that's leading to the dangerous
26 arrhythmia, and those patients we can consider
27 cured.
28 Q So a patient who comes to you who has an
29 arrhythmia, the irregular heartbeat, you can treat
30 sometimes with medicine and sometimes with
31 surgery?
32 A Correct.
33 Q And you do the surgery yourself?
34 A Correct.
35 Q Tell us about that. What do you do once you're in
36 there, as it were, and doing this surgery? What
37 are you doing?
38 A Right. So I will clarify. The types of
39 procedures I do are either device implantations,
40 where we implant the pacemakers or defibrillators,
41 or the ablation procedures, which are invasive
42 procedures but it's not open chest surgery.
43 Everything is done from the inside out, from the
44 inside meaning we thread a catheter through the
45 major blood vessels in the leg up into the heart,
46 and with the aid of an x-ray camera, we can map
47 very focused areas inside the heart to search for

Dr. Zian Tseng (Medical presenter)
Questions by Mr. Vertlieb

1 these areas of dangerous rhythm.

2 Q So this is surgery you are doing yourself?

3 A Correct.

4 Q And you go into the heart. Do you actually cut
5 into the --

6 A No, no open heart surgery. In fact, probably 30
7 or 40 years ago some of these rhythms had to be
8 cured by open heart surgery, and the catheter
9 ablation procedure which electrophysiologists
10 around the world perform was invented at UCSF 25
11 years ago. So we go in from the leg up into the
12 heart via the blood vessel without cutting open
13 the chest.

14 Q Now tell us about the other work where you're
15 implanting a defibrillator. Just tell the
16 Commissioner about that.

17 A So there are certain cardiac conditions which
18 place patients at risk for sudden arrhythmias,
19 which are otherwise lethal, and the only cure or
20 antidote, if you will, for these arrhythmias is to
21 defibrillate the patient very quickly before it
22 leads to death. And one of the seminal inventions
23 in our field is the implantable defibrillator,
24 which is essentially a pacemaker plus, if you
25 will. It's a pacemaker plus a defibrillator.
26 It's implanted in the chest under the muscle and
27 the wires into the heart are threaded through the
28 blood vessels in the chest into the heart into
29 specific locations within the heart, and the
30 defibrillator then continually monitors the heart
31 rhythm and will shock a heart rhythm that's
32 dangerous within a few seconds to restore a
33 patient's rhythm and essentially save their life.
34 In the process of doing such a procedure, such a
35 surgery, we will purposefully induce ventricular
36 fibrillation in the operating room in order to
37 confirm that the device can accurately and
38 reliably defibrillate the heart.

39 Q So this is surgery that you are doing.

40 A Correct.

41 Q And that's inside the cavity.

42 A So it is in the chest wall, but the leads are
43 threaded through a blood vessel in the chest, so
44 it's not actual open heart, exposure of the heart,
45 which is crucial because it allows for a one-day
46 recovery period for the patient rather than
47 approximately a week for open heart surgery.

- 1 Q So now to do this surgery, fibrillation -- give
2 the Commissioner the simple way you'd explain it
3 to a patient. What does fibrillation mean?
- 4 A So ventricular fibrillation is a chaotic rhythm of
5 the bottom chambers of the heart. The ventricles
6 are the bottom chambers of the heart. And in
7 order to sustain cardiac output for life, the
8 bottom chambers of the heart need to be
9 synchronized in the normal electrical fashion in
10 order to provide life sustaining cardiac output.
11 When a patient goes into ventricular fibrillation,
12 it's a state of a chaotic rhythm which does not
13 allow for contraction of the heart, and
14 essentially no cardiac output. So one of the, I
15 think, very visual but pretty accurate
16 descriptions of ventricular fibrillation is that
17 the heart wriggles like a bag of worms. It's not
18 contracting; it's not pumping; it's not squeezing.
19 It's just writhing in a dyscoordinate fashion.
- 20 Q So what does the defibrillator do when this
21 fibrillation is going on? Just tell the
22 Commissioner.
- 23 A So a defibrillator will first sense this rhythm as
24 an irregular, rapid, dangerous rhythm and deliver
25 a life-sustaining shock to convert the rhythm back
26 to a normal sinus rhythm.
- 27 Q Would it be like rebooting a computer, in other
28 words?
- 29 A I suppose, yes.
- 30 Q Tell us, when you're going to do that work, do you
31 start and stop the heart as part of that surgery?
- 32 A In order to make sure that we put a patient
33 through a surgical procedure for a good reason, we
34 need to confirm that the defibrillator is working
35 properly. So in the operation, I will
36 purposefully induce ventricular fibrillation by
37 delivering a shock at a critically timed
38 vulnerable period in the cardiac cycle, which
39 reliably induces ventricular fibrillation.
- 40 Q So you can mechanically make the heart stop the
41 normal proper beating, and make it do this
42 flutter, as you called it, like a bag of worms?
- 43 A It's actually an electrical means.
- 44 Q How do you do that?
- 45 A The defibrillator itself we can program to deliver
46 the shock at any time, and so we program the
47 device to sense the vulnerable period and deliver

1 this small shock at the time of the vulnerable
2 period to induce ventricular fibrillation.

3 Q What do you mean by the vulnerable period?

4 A So the vulnerable period is a very specific part
5 of the electrical cardiac cycle, at which time the
6 heart itself is recovering for the next heartbeat,
7 electrically, and at a very small window within
8 that recovery period there is a time in which a
9 critically timed electrical shock, or even a
10 mechanical shock, can induce ventricular
11 fibrillation. And I'll be showing some examples
12 of that in my presentation.

13 Q So you can with electricity cause fibrillation?

14 A Correct.

15 Q And then you use the defibrillation. Tell the
16 Commissioner about that.

17 A So there are several types of defibrillators. One
18 is the internal implantable defibrillator that I
19 implant. Another is the kind of defibrillator
20 that's used in the coronary care unit of hospitals
21 or in the emergency room of hospitals or in the
22 paramedic ambulances, which require advanced
23 personnel to use, but essentially delivers life-
24 sustaining shock to restore cardiac rhythm from
25 the outside. And then the third kind of
26 defibrillator, which has been recently increasing
27 in adoption, is the automatic external
28 defibrillator, which is a dummy-proof
29 defibrillator which in the United States we've
30 deployed in areas of large public spaces, if you
31 will, where sudden cardiac arrests are not
32 uncommon, and any layperson could take this AED,
33 automatic external defibrillator, off the wall and
34 apply it to a sudden cardiac arrest victim and
35 restore cardiac rhythm.

36 Q How often in a year would you do this work where
37 you're stopping the heart from normal proper
38 beating with electricity? How often?

39 A So I typically do 150 to 200 devices a year.

40 Q And what is the reason that fibrillation is of
41 such concern to you, and to your patients
42 obviously?

43 A Sudden cardiac death is, I think, one of the
44 biggest public health problems in the world, in
45 the western world particularly, and it's the focus
46 of my research. Despite advances in other fields
47 of cardiology like heart attacks, myocardial

1 infarctions, and heart failure, sudden cardiac
2 death, remains, in the United States, about half a
3 million per year, half a million incidents per
4 year. And it's universally fatal unless the
5 rhythm is defibrillated into normal cardiac
6 rhythm. And I'll be showing some data to
7 demonstrate that time to defibrillation is key in
8 survival.

9 Q What percent of cardiologists would be an
10 electrophysiologist?

11 A I don't have the statistics off the top of my
12 head, but off the top of my head I would say about
13 5 to 10 percent of cardiologists have additional
14 training in arrhythmias to qualify and be board
15 certified in cardiac electrophysiology.

16 Q So you are a cardiologist.

17 A Correct.

18 Q And an electrophysiologist.

19 A Correct.

20 Q What does the electrophysiologist training mean
21 you do, then?

22 A So I complete all my cardiology training and I
23 undergo an additional two years of fellowship
24 training in consultations for arrhythmias, in
25 advanced EKG reading, in surgical training for
26 implanting devices and for ablation procedures,
27 and other advanced diagnostic techniques.

28 Q And today approximately what proportion of your
29 work, then, is treating people and doing this
30 research?

31 A About half, fifty-fifty.

32 Q Tell us how you came to be in this field of
33 medical work? How did that happen?

34 A I think it satisfies my intellectual curiosity for
35 tackling a problem of large public health
36 significance. It allows me to treat patients
37 anywhere from seven years old to 70 years old or
38 older, whereas most cardiologists typically treat
39 coronary disease, which happens in middle age or
40 later in life. So I get to treat a broad spectrum
41 of patients. I get to cure patients of their
42 arrhythmia, a true cure rather than just treating
43 a chronic disease like high blood pressure or
44 diabetes or heart attack.

45 Q We anticipate that a colleague named Dr. Charles
46 Kerr is going to come and inform the Commissioner.
47 Do you know of Dr. Charles Kerr from Vancouver by

1 reputation?

2 A Yes. I don't know of him personally but I
3 understand he has an excellent clinical
4 reputation.

5 Q Just before we embark on your presentation, tell
6 us about your coming into the field of knowledge
7 concerning Taser.

8 A Well, it was actually quite a bit by mistake, or
9 by circumstance, I should say. Just about three
10 years ago, three and a half years ago, in the San
11 Francisco Bay area, a very similar, highly
12 publicized Taser-related death occurred, and the
13 local media, the *San Francisco Chronicle*,
14 contacted our department asking to speak to the
15 chief of my department, my boss, seeking comment
16 on how could a Taser potentially induce a
17 dangerous arrhythmia. And lucky for me, or
18 unlucky for me, nobody else was in the office and
19 I was the only one to answer the phone, so I put
20 forth this hypothesis that Tasers could induce
21 cardiac arrhythmias. Unbeknownst to me, this was,
22 I think, not a widely publicized hypothesis, or
23 certainly nobody had really publicly declared this
24 hypothesis, and I got a lot of media attention at
25 the time for it even though I was not actively
26 seeking it and it was completely out of my field
27 of research. Shortly thereafter I was contacted
28 by Taser directly to reconsider my statements to
29 the media, and they even offered to support my
30 research, to give me grant funding to support
31 research. And in order to remain independent, I
32 declined, and furthermore, in my mind it was
33 outside of my field of research.

34 Subsequent to that over the last three years,
35 I've come to realize that this is quite a debate
36 in the public arena and that there are real risks
37 with Taser use, and I've come to know the
38 literature very well and to do some side projects
39 in Taser research.

40 Q I think this would be a good time, Dr. Tseng,
41 would it, to take the Commissioner through your
42 presentation?

43 A I'd be delighted.

44 MR. VERTLIEB: Thank you, sir.

45
46
47

1 PRESENTATION BY DR. TSENG:
2

3 A So I thought I would review the cardiac and
4 physiologic effects of Taser use and then consider
5 the real world implications of Taser use. And
6 then, if you'll allow me, I will put forth my
7 recommendations for its use.

8 By way of full disclosure, my research
9 support is from the National Institutes of Health.
10 I have a grant, you see there, from the National
11 Institutes of Health and I have no other research
12 support funding.

13 So what I'll talk about today is some basic
14 introduction to cardiac electrophysiology and the
15 concept of lethal arrhythmias. We'll consider the
16 theoretical evidence for vulnerability for Taser-
17 induced cardiac arrest, the animal evidence, the
18 human evidence, and real world evidence, and then
19 I'll take you through what I think are the
20 conclusions from the studies so far, and then give
21 my recommendations.

22 Let me first start by introducing the normal
23 conduction system, the normal electricity in the
24 heart, if you will, and to also define the
25 electrocardiogram. And here on the left we have
26 the normal cardiac rhythm, nice and slow, nice and
27 orderly and nice and coordinated. You have the
28 P-wave, which is this first hump here, the QRS,
29 the T-wave, and then the interval known as the
30 QT interval between the QRS and the end of the
31 T-wave. The P-wave represents contraction of the
32 upper chambers of the heart here, the atria, which
33 take blood from the veins of the body and with
34 contraction feed the ventricle, which with
35 contraction gives you the QRS and ejects blood
36 into the rest of the body or the lungs to sustain
37 life. The T-wave is the peak of the recovery
38 period and the peak of the T-wave represents the
39 vulnerable period. So this peak of the T-wave
40 represents about 3 percent on average of the ECG
41 cycle, the EKG cycle. And this window, this
42 vulnerable period, can be expanded by numerous
43 conditions, be it underlying cardiac disease, be
44 it acid base disorders, be it metabolic
45 derangements, be it cocaine, be it adrenaline
46 increase. So this concept of the T-wave being the
47 vulnerable period is what I'll be focusing on in

1 the next few slides.

2 So in terms of defining the ventricular
3 arrhythmias which we discussed earlier, the rhythm
4 of ventricular fibrillation is a fatal cardiac
5 rhythm causing no coordinated cardiac output. So
6 you see here this very chaotic, greater than 300
7 beats per minute, rhythm as contrasting with this
8 very organized, nice, slow cardiac output
9 sustaining rhythm.

10 A close cousin to ventricular fibrillation --
11 and I will mention, as we did, that this is an
12 almost universally fatal rhythm unless
13 defibrillated. A close cousin to ventricular
14 fibrillation is ventricular tachycardia, which is
15 also a potentially fatal rapid cardiac rhythm that
16 produces uncoordinated contraction, low cardiac
17 output, and this itself can degenerate into
18 ventricular fibrillation and this is considered a
19 medical emergency as well. So your heart is
20 contracting 200 or so beats per minute on average
21 in this condition and not sustaining very much
22 cardiac output, and if this rhythm persists for
23 very long, it often degenerates into this fatal
24 rhythm.

25 So this is an example of what I do every day
26 in the operating room. Here is the normal ECG, P,
27 QRS and T-wave and the QT interval, which
28 represents, as I mentioned earlier, the recovery
29 period of the heart. As you see here, I deliver
30 an electric shock right on the peak of the T-wave
31 and induce ventricular fibrillation. And here we
32 have an anaesthesia monitor of the blood pressure,
33 and you see here with the ventricular contraction
34 we get a nice blood pressure, and a nice blood
35 pressure again with the second heartbeat. We
36 deliver the electric shock, and with this rhythm
37 here the blood pressure drops to zero. So this,
38 if it continues, would be a fatal rhythm.

39 So this fatal rhythm, this ventricular
40 fibrillation, can occur intrinsically as well.
41 This is a patient of mine who has underlying heart
42 disease. He has abnormal QT interval here. His
43 QT interval is abnormal because of his underlying
44 heart disease and also metabolic derangements.
45 You see that he himself intrinsically has these
46 PVCs that occur as contrasted with these nice,
47 normal, narrow, coordinated electrical beats here.

1 And you see that he himself, unfortunately, had a
2 PVC timed upon his own T-wave and induced VF on
3 his own. So this is an example of what you might
4 find in a person who drops dead suddenly from
5 sudden death due to ventricular fibrillation in
6 the public arena.

7 There's also another condition called
8 commotio cordis, which may be difficult to see
9 here, but something like a mechanical trauma to
10 the chest itself can induce ventricular
11 fibrillation. So you can have your own PVCs, you
12 can have an electrical shock that I time
13 perfectly, or you can have an unfortunately timed
14 mechanical chest wall trauma. And this was
15 discovered in contact sports actually, in baseball
16 and hockey, where children playing baseball or
17 hockey would have the baseball or the hockey puck
18 strike the chest and they would drop dead
19 suddenly. And with research and monitoring, it
20 turns out that the low energy chest wall trauma
21 occurred right on the T-wave and induced
22 ventricular fibrillation in these victims.

23 So here is an example of resuscitation from
24 ventricular fibrillation. Here on the right is a
25 schematic of the implantable defibrillator that I
26 do and any electrophysiologist does every day,
27 implanting a defibrillator with the wire threaded
28 into the heart. This defibrillator senses this
29 chaotic ventricular fibrillation rhythm which you
30 see here, delivers its shock and restores normal
31 contraction and normal rhythm here.

32 Here is an example of an AED, which I
33 mentioned, the automatic external defibrillator
34 which in the United States you can buy for about
35 \$1,000 and, as I mentioned, are commonplace in all
36 of our airports.

37 THE COMMISSIONER: Is the timing important?

38 A Yes. Oh, I'm sorry. The timing for a
39 defibrillation is not important. However,
40 accurate identification of rhythm is important.
41 In other words, if you shock the heart which is in
42 normal rhythm you may hit that vulnerable period
43 and instead induce ventricular fibrillation, so --

44 THE COMMISSIONER: I meant when you pull it out.

45 A These defibrillators are meant to be used by the
46 layperson, so anybody can put these pads on the
47 chest of a victim and the computer in the device

1 will read the rhythm and give you a recommendation
2 of either to shock or not to shock. So these are
3 pretty much dummy-proof. And they've resulted in
4 a significant improvement in survival from cardiac
5 arrest in the States.

6 So here is an example of what I mentioned,
7 that time to defibrillation is key to survival.
8 This was a paper in the *New England Journal* by one
9 of my colleagues, showing the time to
10 defibrillation and survival from cardiac arrest.
11 Here on the Y axis is survival from cardiac
12 arrest, here is time to defibrillation. You'll
13 see that within one or two minutes, you can have
14 50 percent or higher survival, and if you wait any
15 longer than that to ten minutes, it's down to
16 10 percent, and almost zero any longer than that.
17 So time to defibrillation is key. The minute you
18 have ventricular fibrillation, you're not having
19 any cardiac output. Within two to four minutes
20 you have irreversible brain death and that's the
21 main reason for not surviving a cardiac arrest.

22 So I'd like to highlight some conditions that
23 might change this vulnerability for ventricular
24 fibrillation. What I showed earlier can happen to
25 any healthy person, so we all have this
26 vulnerability to ventricular fibrillation with a
27 properly timed either mechanical or intrinsic or
28 electrical shock of sufficient strength.

29 Things that might increase your vulnerability
30 for ventricular tachycardia or ventricular
31 fibrillation are underlying cardiac disease. So
32 if you've had a previous myocardial infarction,
33 otherwise known as a heart attack, if you've had a
34 previous heart attack, you'd have increased risk
35 for these rhythms. If you have heart failure of
36 any cause you'd have an increased risk for these
37 rhythms. It's been well shown that if you have
38 high adrenergic tone, meaning high adrenaline in
39 your system, you have a higher vulnerability for
40 ventricular tachycardia and ventricular
41 fibrillation.

42 And there's two lines of evidence that are
43 pretty interesting supporting this. Number one,
44 cardiac arrests are most common early in the
45 morning when we all have our highest levels of
46 adrenaline. Secondly, cardiac arrests surge with
47 any stressful event, so the Los Angeles

1 earthquake, the Tokyo earthquakes, we saw a spike
2 of these sudden deaths. Any natural disaster we
3 see a spike of these sudden deaths.

4 Illicit drugs like cocaine or methamphetamine
5 are well known to decrease the threshold or
6 increase your vulnerability for these rhythms.

7 Acid base disturbances. So if you have acid,
8 the pH in your blood is too acid, then you are at
9 increased risk. If you have electrolyte
10 disturbances, particularly potassium disturbances
11 and low potassium in particular or even high
12 potassium, which may occur in, say, a patient with
13 renal failure, these can increase your
14 vulnerability.

15 And then these are rare conditions that I see
16 in my clinic or any electrophysiologist sees,
17 which are inherited genetic cardiac electrical
18 diseases that place you at increased risk.

19 One thing I will highlight is a condition
20 called Long QT syndrome, which is quite rare. But
21 it's an inherited condition where you have
22 abnormal repolarization or abnormal QT intervals
23 in the heart, and those patients are at much
24 increased risk for sudden death.

25 So let me spend a minute on Taser electrical
26 outputs. What the Taser does is deliver a high
27 voltage discharge but with very short pulse
28 durations. It delivers an initial 3 microsecond
29 electrical pulse followed by longer 100
30 microsecond pulses. And what's important is the
31 current that reaches the heart. It doesn't matter
32 so much what you hear about voltage, duration or
33 energy. It's all about how much current reaches
34 the heart. So here we have, courtesy of the
35 Nanthakumar review article, which I forwarded to
36 your office, a comparison of approximate
37 electrical characteristics of common sources of
38 high voltage shocks: lighting; the internal
39 defibrillator; electrostatic discharge, otherwise
40 known as static electricity; shock from line
41 voltage, meaning unfortunate children who might
42 have stuck their hand into the wall socket; shock
43 from electroconvulsive therapy, which may be used
44 in psychiatry; and then the Taser. You see here
45 that the voltage is much, much higher than any of
46 these other sources. However, the amount of peak
47 current is on the same order of magnitude as, say

1 for example, the internal defibrillator, but the
2 pulse duration is much shorter, about an order of
3 magnitude shorter, 0.1 millisecond as opposed to 7
4 to 30 milliseconds. And then the amount of energy
5 is also about an order of magnitude less than the
6 internal defibrillation I mentioned, but you see
7 the current is similar.

8 But I will mention, which I forgot to
9 mention, that the energy for defibrillation is
10 approximately 30-fold higher than the energy to
11 induce ventricular fibrillation. In other words,
12 the shock that I deliver to induce ventricular
13 fibrillation only needs to be 30-fold less than
14 the shock that I deliver to save the heart. So
15 the strength of a shock that may be dangerous is
16 much less than a life-saving shock.

17 So I'll also review some of the physiologic
18 effects of Taser application. What I've
19 highlighted in white here are things that are
20 probably well accepted, and well accepted by
21 TASER. Things here in yellow are things that are
22 more controversial and that TASER will dispute,
23 but I believe that the evidence will prove the
24 case for these physiologic effects as well.

25 So the effects increase with duration of
26 application, meaning if you get one shock, it's
27 much less of a physiologic effect than two shocks
28 or three shocks. And a shock that's of a longer
29 duration will increase your physiologic effects
30 additively.

31 The way it works is it inhibits voluntary
32 function of your skeletal muscles, so it
33 overwhelms the voluntary control of your muscles
34 by overtaking your function of your muscles. So
35 the Taser electrical pulses will stimulate your
36 motor and sensory nerves and give you locked
37 muscles and also cause intense pain during the
38 time of Taser application. So subjects are
39 typically dazed, immobilized and weak for 5 to 15
40 minutes after application. And there have
41 certainly been reports of eye injury with the
42 Taser barbs penetrating the eye, miscarriage.
43 Rhabdomyolysis is a fancy term we use for muscle
44 injury. From repeated Taser applications your
45 muscles become damaged from continuous Taser
46 application. And then there have been reports of
47 brain penetration of the darts. I mentioned the

1 intense pain.

2 And one important point I'll mention is that
3 there can be no autopsy findings in a sudden
4 arrhythmic death, meaning if somebody collapses of
5 sudden death and an autopsy is done and they find
6 no cause of death, then almost certainly it's an
7 arrhythmic sudden death.

8 Metabolic acidosis is something where due to
9 these physiologic changes, be it the pain, be it
10 the muscle injury, you have conditions which
11 decrease the pH in your blood, meaning your blood
12 become acidotic, and that increases your
13 vulnerability to these ventricular arrhythmias.
14 There's debatable evidence for that and I'll
15 review that.

16 There have been studies in humans to show
17 that the QT interval is affected in individuals
18 shocked with the Taser. The risk for cardiac
19 arrhythmias in the immediate period after Taser
20 application, there have been demonstration animal
21 models of cardiac capture leading to VT or T shock
22 leading to VF.

23 And I will also mention that just because
24 somebody collapses of sudden death minutes later
25 after Taser application doesn't mean that the two
26 are not connected. I would say that the pain, the
27 adrenaline increase, the acidosis, the QT changes,
28 are all seen in subjects Tasered, and those
29 changes may lead somebody to be more vulnerable to
30 cardiac arrest on their own.

31 I'll also introduce this concept of "excited
32 delirium," which I've put in quotations because
33 there is debate in the medical community about
34 whether or not this exists at all. But assuming
35 that it does, there's the possibility of additive
36 risk for death from excited delirium. In other
37 words, the death may have been due to excited
38 delirium, but the Taser may have been causative or
39 additive to that risk.

40 Let me first introduce the theoretical
41 constructs that are put forth for the risks of
42 Taser. And admittedly, a lot of the theoretical
43 constructs demonstrate quite a high threshold of
44 safety for the Taser. And it's based on the fact
45 of capture of the heart. So can these pulses from
46 the Taser capture the heart and overtake the
47 heart? The concept here is that there is an

1 inverse relation between the duration and the
2 current of pulse. In other words, if the pulse
3 duration is short, then you need higher current.
4 so the thought is that -- or the theoretical
5 construct is that these pulse durations are so
6 short that the current, even though there is given
7 level of current, the pulse duration is too short
8 to capture the heart.

9 Furthermore, they say that the Taser
10 delivers 19 pulses per second, and those 19 pulses
11 per second are well beyond the recovery period of
12 the heart. The heart cannot be captured at that
13 fast a rate because it needs time to recover. The
14 assumptions that are made are that only 4 to 10
15 percent of the current that reaches the chest wall
16 will affect the heart. There's an assumption of
17 high pacing threshold from the body surface, and
18 then the long recovery period of the cardiac
19 tissue, as I mentioned, and the short duration of
20 Taser pulses.

21 Now, what's not allowed in these theoretical
22 calculations are worst case scenarios. And what
23 do I mean by that? Assumption that only 10
24 percent of the current reaching the heart is an
25 assumption in mathematical models, and this
26 current may be increased if the barbs are placed
27 in such a way as to capture the heart in the
28 optimal vector. If the barbs penetrate the skin
29 rather than just the clothes, that would render
30 that assumption not valid.

31 THE COMMISSIONER: Would you remind us again of your
32 definition of "capture."

33 A I will. And I will show some of that evidence a
34 little bit later, and if you still have questions,
35 I'll be happy to go over that again.

36 The concept that the Taser cannot capture the
37 heart because it gives 19 pulses per second and
38 that's beyond physiologic possibility for the
39 heart is also flawed in that you don't have to
40 capture every single pulse. It can be every
41 other. It can be every third. It can be every
42 fourth. And whatever that timing is, when the
43 heart is vulnerable, it can be captured and can
44 overtake the heart to give a fatal rhythm. I'll
45 review that in a second here.

46 So let me move on to some animal studies.
47 One of the most quoted animal studies is a study

1 by McDaniel published in *PACE*, which is one of the
2 electrophysiology journals. Their conclusions
3 were that the stun guns do not cause ventricular
4 fibrillation in a pig model. They describe a
5 safety margin of 15 to 42 times with standard
6 current that the Taser applies. And they show
7 that a safety margin is inversely correlated with
8 weight. And what does that mean? It means
9 smaller animals had an easier time to induce
10 fibrillation than larger animals.

11 Some caveats here are that the study was
12 funded by a Taser grant and several of the authors
13 were employees of Taser. Now, I mentioned that
14 only to say that there is an appearance of
15 conflict of interest but not necessarily of bias,
16 but it's something to keep in mind. They used a
17 stun gun simulator and not the Taser itself. They
18 constructed a device that simulated the Taser but
19 it was not the actual Taser barbs from the Taser
20 gun. And with this simulator they were able to
21 specify the safety margin, deliver different
22 electrode spacing than you might see in the field.
23 And finally of course, these pigs were all under
24 general anaesthesia.

25 Another often quoted study is a study by
26 Lakkireddy appearing in one of the foremost
27 cardiology journals, the *Journal of the American*
28 *College of Cardiology*, a couple of years ago. And
29 their conclusions were that stun guns did not
30 cause ventricular fibrillation in a swine model,
31 in a pig model, and they concluded also -- what
32 they did was infused cocaine in these pigs and
33 they actually found that safety margin for
34 ventricular fibrillation was doubled, meaning it
35 was twice as hard to induce ventricular
36 fibrillation in these pigs. This directly
37 contradicts human studies which show that cocaine
38 decreases your threshold for ventricular
39 fibrillation.

40 Again, this study was funded by Taser, not to
41 say that that definitely means bias, but again,
42 conflict of interest. This was, again, a stun gun
43 simulator and not a Taser and they were allowed to
44 then specify the safety margin by dialling the
45 simulator up or down. And again, they had
46 different electrode spacing in this study. The
47 pigs were all under general anaesthesia. What was

1 mentioned in the body of the text but not in the
2 conclusions was that the stun gun did actually
3 influence the heart rate during the shock,
4 suggesting the possibility of capture of the heart
5 during the Taser shot. And they also found that
6 the ability of the Taser to capture the heart was
7 critically dependent on the vector that was
8 applied. In other words, a vector right across
9 the heart was much easier than over the back or
10 over the abdomen.

11 I will point out a seminal study by one of
12 the cardiologists and electrophysiologists here in
13 the University of Toronto published in the same
14 issue of *JACCI*, which found the exact opposite.
15 What he did was he put pigs under general
16 anaesthesia, he put catheters inside the heart of
17 the pigs and he put blood pressure tracings on
18 these pigs. He used the actual Taser guns.
19 Again, this was also anaesthetized pig model.

20 This research was funded by the Canadian
21 Institute of Health Research. And what he showed
22 was that during the Taser shock, the blood
23 pressure became zero, pumping of the heart
24 stopped, and arrhythmia was induced or the heart
25 was stimulated so rapidly that it was not able to
26 result in cardiac output. He found that about
27 half of the shocks that he performed captured the
28 myocardium.

29 So 50 percent of the 150 shocks that he did
30 in six pigs captured the heart and caused no blood
31 pressure. Again, he found that it was critically
32 dependent on the vector of the barbs, where the
33 vector was most vulnerable when it was across the
34 heart, such that 80 percent of the shocks across
35 the heart captured the myocardium, whereas zero
36 percent of the shocks away from the chest captured
37 the myocardium. And he found that the X26 model
38 had a higher risk than the M26 model, which have
39 different current outputs.

40 So here is an example of capture of the heart
41 in his study. Here you have the intracardiac
42 tracing. So what you see here is the time during
43 the Taser application. And what's really
44 difficult in any study with Taser and EKGs is that
45 the electrical noise from the Taser overwhelms the
46 EKG, so you cannot see what's going on underneath
47 in the EKG. He got around that by putting

1 catheters inside the heart to record the
2 electrical signal from the inside, and with these
3 electrical signals inside the heart he was able to
4 demonstrate ventricular capture. So this would be
5 the equivalent of VT, of ventricular tachycardia.

6 Here is your normal cardiac rhythm. During
7 the Taser application, for the whole duration
8 you've captured the heart. Again like I
9 mentioned, not every single pulse of the Taser was
10 capturing the heart. You'll see here only every
11 third pulse of the Taser is capturing the heart,
12 but that was still enough to give you a heart rate
13 of 250-plus beats per minute, essentially allowing
14 no blood pressure. And you see here, here's the
15 blood pressure tracing during the normal rhythm,
16 which is blown up right here. You have nice blood
17 pressure. During the capture of the Taser, you
18 have zero blood pressure. Release of the Taser,
19 your rhythm comes back.

20 He further went to simulate an excited state
21 with adrenaline infusion. So he infused these
22 anaesthetized pigs with adrenaline to simulate the
23 excited state, and he found that with adrenaline
24 that increased it further; you now went to 81
25 percent of Taser shocks captured the myocardium.
26 So he demonstrated that with adrenaline it
27 increased your vulnerability for capturing the
28 heart.

29 Now, I want to mention that he demonstrated
30 both mechanisms of lethal arrhythmias, one being
31 capture of the heart leading to ventricular
32 tachycardia essentially here with zero cardiac
33 output. And the risk for this rhythm is only
34 during the capture of the Taser. He also
35 demonstrated here -- I apologize. It's probably
36 not well seen. But he demonstrated here the
37 possibility of T shock causing VF as well. So not
38 only can you capture the heart with the Taser
39 pulses, albeit every third pulse or every fourth
40 pulse and not every single pulse, but if one of
41 those shocks was critically timed, it could induce
42 ventricular fibrillation as well. So this,
43 probably not well seen, but the reference is
44 there. One of the pulses happened on the T-wave
45 and induced ventricular fibrillation here. Again,
46 blood pressure is here and it goes to zero from
47 normal.

1 So I classify that as a seminal study in the
2 field. It was the first demonstration of
3 myocardial capture and rhythmic risk in an animal
4 model.

5 I will mention that in scientific research,
6 the discovery is important but replication is just
7 as important. So sure enough, a second research
8 team replicated his studies. So last year in the
9 *Journal of Trauma*, and repeated again by the same
10 team this year twice, they used the same
11 anaesthetized swine model. They were funded by
12 the university. All animals demonstrated
13 myocardial capture during the Taser application.
14 They found furthermore that two of the ventricular
15 fibrillation episodes resulted in death of the
16 pig, and they also confirmed that the vector was
17 critical.

18 One of the points that they made in the study
19 was that because the pig was anaesthetized they
20 were not feeling pain, so despite taking pain out
21 of the equation, they were able to induce
22 ventricular capture.

23 THE COMMISSIONER: And the pain goes to adrenaline
24 flow?

25 A Correct. So you can imagine with intense pain,
26 then your own adrenaline surge will surge
27 throughout your body, and as Nanthakumar showed,
28 that increases your vulnerability for ventricular
29 fibrillation.

30 THE COMMISSIONER: What is your word for the
31 adrenaline? You had a chemical word.

32 A Epinephrine, which is the medical term for
33 adrenaline.

34 And so here, a figure from his article
35 shows -- again, here's your normal rhythm of the
36 pig. During the Taser application here, the EKG
37 is overwhelmed, but after release of the Taser you
38 have ventricular fibrillation.

39 So let's move now to human studies. Of
40 course any critique of animal studies is correct
41 in that there are important anatomic and
42 electrophysiologic differences between pigs and
43 humans. It is also true that ventricular
44 fibrillation and ventricular tachycardia are more
45 easily induced in pigs than in humans. So there
46 are important anatomic and electrophysiologic
47 differences that may make any pig model hard to

1 extrapolate to humans.

2 Nevertheless, there have been human studies
3 done, and these have been universally in rested,
4 healthy police volunteers who have had no drugs.
5 They've been screened for having no drugs. They
6 all have low heart rates. In fact, in some of the
7 studies, anybody with a high heart rate was
8 excluded from the Taser application. They were
9 not exercising. They were not resisting police,
10 if you will. They were not having high
11 adrenaline. And almost universally the studies
12 shot subjects in the back and not over the chest.
13 And in some of the studies the vector was not
14 reported, so we cannot know in those studies. But
15 all the studies, in the methods, if you read the
16 methods, the vector was across the back.

17 One of the often cited studies is a study by
18 Dr. Ho, who published two years ago in an
19 emergency medicine journal. He did this study in
20 66 resting adult volunteers. He showed no cardiac
21 effects in these adult volunteers, and he also
22 showed no potassium or bicarbonate disturbances.
23 And he concluded from this that there is no
24 acidosis.

25 Now, important caveats to this. Again there
26 was Taser funding. Not to say that that
27 automatically means bias but it's something to
28 keep in mind. The vector was across the back.
29 All of the police volunteers were subjected to a
30 single Taser application and not multiple Taser
31 applications and no longer than five seconds.

32 Interestingly, he concluded this: no cardiac
33 effects in 66 of the volunteers but he only
34 recorded EKGs in 32 of them. He recorded before
35 and after but not during. Remember I showed you
36 that during the Taser, the Taser electrical noise
37 overwhelms the EKG so you do not know what's
38 happening during the Taser application. So it's
39 not surprising after the Taser is released that
40 you can have normal rhythm before and after. The
41 EKG intervals were not reported. He simply stated
42 EKGs were normal before and after. Did not give
43 intervals, did not show any EKGs.

44 He also says that bicarbonate did not change
45 and therefore there couldn't have been acidosis,
46 and that's a little bit of a stretch. The gold
47 standard for measuring pH is getting an arterial

1 blood sample and not looking at bicarbonate
2 because bicarbonate can be corrected by
3 respiration or other electrolytes. He also does
4 not mention the time points. The time points are
5 critical in taking these EKGs and taking these
6 blood samples. Immediately after the Taser
7 application, there may have been changes that were
8 missed if you drew the blood five minutes later or
9 ten minutes later. So time points were not
10 recorded.

11 Another research group that published often
12 about Taser applications in humans is an emergency
13 medicine research group out of San Diego. Vilke
14 and Chan are the two investigators that publish
15 together. And they found in their conclusion in
16 this particular paper no cardiac effects in 32
17 resting adult volunteers. They found no cardiac
18 arrhythmias and they found no clinically relevant
19 ECG changes.

20 Again, caveat here is that funding was not
21 reported in this particular study. These were 32
22 healthy volunteers, so anybody with any health
23 problems were excluded. Anybody with high heart
24 rates were excluded. The vector was over the back
25 or was not reported. And these were single Taser
26 applications. The QT interval they report as
27 having shortened and lengthened, and they say it's
28 not clinically relevant. Well, I will venture to
29 counter that that is clinically relevant. It
30 demonstrates that there had been changes to the
31 repolarization period in the cardiac cycle due to
32 whether it be the direct cardiac effect of the
33 Taser or the intense pain and the adrenaline
34 causing these EKG changes.

35 They also demonstrated in these police
36 volunteers a lower pH. So they demonstrated acid
37 changes immediately after the Taser, and that can
38 contribute to vulnerability of cardiac
39 arrhythmias.

40 This is the same group. Levine published
41 with Vilke and Chan, and this was a study from
42 2007, again in 105 healthy police volunteers.
43 Funding was not reported. The vector was across
44 the back. There was a single five-second Taser
45 application. Now, what he shows here is that
46 here's your normal EKG before. During the Taser
47 application the noise is overwhelmed so you can't

1 tell what's happening. Is the heart captured or
2 not? You cannot rule that out here with this EKG.
3 But most likely not, given that the vector is
4 across the back. After the Taser shock, there's a
5 lot of noise from artefact from writhing around in
6 pain, and then he recovers to a little more normal
7 rhythm. But this is a continuous rhythm strip
8 here and these are seconds apart only and you can
9 see here that the QT interval has lengthened
10 relative to this interval here, which is much
11 shorter. So he demonstrates in this study that in
12 some of these subjects there have been QT interval
13 changes, which suggests that the repolarization
14 period may have been affected in these police
15 volunteers.

16 Now, what I'll mention here is that even with
17 the vector across the back, so presumably you're
18 not even capturing the heart, you're still causing
19 these ECG changes, be it with the pain, be it with
20 the skeletal muscle contraction, whatever it is,
21 the physiologic effects are leading to QT interval
22 changes here.

23 And admittedly, it's an extrapolation to say
24 that these QT interval changes mean that somebody
25 can have cardiac arrest, but suffice it to say
26 that QT interval increase is a significant risk
27 factor in my field for arrhythmias.

28 So this was a seminal article demonstrating
29 that you can capture the heart with a vector in a
30 human. So this was a study from Los Angeles from
31 last year, and the title of their study was
32 "Taser-induced rapid ventricular myocardial
33 capture demonstrated by pacemaker." Remember I
34 said the conundrum with the Taser and an EKG
35 across the chest is that the Taser will overwhelm
36 the noise from the EKG so you cannot tell if the
37 Taser is capturing the heart or not. So one way
38 around that is if the subject happens to have a
39 pacemaker inside. So this was a person that
40 happened to have a pacemaker and he was shocked
41 with the Taser, and during the exact time of the
42 Taser shock - here you can see the pulses here -
43 the heart was captured every third Taser beat to
44 result in a heart rate about 240 beats per minute
45 or more during the time of the Taser application.
46 The vector was across the chest in this subject.

47 This also brings up the other risk with Taser

1 application, which is that in any patient with an
2 ICD, with a defibrillator that's been implanted,
3 the Taser noise itself has been sensed as an
4 abnormal rhythm and that can lead to an
5 inappropriate shock in these defibrillator
6 patients. In other words, the Taser pulses are
7 read by the defibrillator as abnormal cardiac
8 rhythm and the device will shock the subject for
9 the Taser shock and not for any dangerous rhythm.

10 So let me shift now to some real world
11 studies, what's out there with real world studies.
12 There's actually not too much out there. But some
13 of the first studies were actually published over
14 20 years ago. This was an emergency medicine
15 journal. What they did was they compared over 200
16 individuals who were subdued by the police with
17 either a firearm or a Taser, and they found one
18 and a half percent, 1.4 percent mortality in the
19 Taser group versus 50 percent in the firearm
20 group. So this is not zero. It's 1.4 percent.
21 It's admittedly much lower than the firearm, which
22 is not surprising. However, it's not zero. It's
23 not non-lethal. It's not non-lethal. There were
24 three fatalities in the Taser group, which were
25 due to cardiac arrest.

26 Dr. Swerdlow, on the other extreme, in next
27 week's Heart Rhythm Society meetings, which I'll
28 be taking a part of, he's going to be presenting a
29 case series of in-custody sudden deaths after
30 Taser use and he's going to be demonstrating two
31 cases of ventricular fibrillation after Taser use.

32 This was a case series of Taser-related
33 deaths, again in the emergency medicine
34 literature, and what they did was they identified
35 75 cases of temporal association between the Taser
36 and death. Only half of them had autopsy reports
37 available for review. All of them were men of
38 young adulthood to middle age. There was cardiac
39 disease in about half of the subjects. Over 80
40 percent of them were on illicit drugs, and 76
41 percent of the deaths were attributed to excited
42 delirium. And they concluded that the use of a
43 Taser was potential or contributory to the cause
44 of death in 27 percent of these cases.

45 So just to highlight that, the human studies
46 that you've seen and the pig studies that you've
47 seen do not replicate the real world application

1 of the Taser where there is half cardiac disease,
2 there may be 80 percent on illicit drugs, 76
3 percent of the deaths may be due to some struggle
4 with police.

5 I think there will be other presenters on
6 this topic, but let me just briefly introduce this
7 because it's important as an explanation that
8 Taser puts forth for Taser-induced deaths. And so
9 this condition, which I've put in quotations
10 because it's highly debated in the medical
11 community whether or not this is an actual
12 condition, it's described as sudden death while
13 being restrained, otherwise known as being excited
14 to death, if you will, due to an overdose of
15 adrenaline. The common scenario is that the
16 subjects are agitated, excitable. They're
17 paranoid. They exhibit aggression and great,
18 great strength. It takes six cops to pin them
19 down, to subdue them. They have numbness to pain.
20 They have racing heart rates. They have fever.
21 It's very commonly associated with cocaine or
22 methamphetamine. It's not recognized by the
23 American Medical Association or the American
24 Psychiatric Association, two of the foremost
25 entities in the States for sanctioning these
26 disorders. It's not recognized as a medical
27 psychiatric disease. But it is recognized by a
28 pathology group, pathology society, as a cause of
29 death. So there's debate in the community.

30 Nevertheless, let's assume that this is an
31 entity and it exists. The explanation as this
32 being the actual cause of death doesn't take into
33 account that the Taser may be additive to that
34 risk. In other words, they may have had excited
35 delirium but without the Taser that might not have
36 resulted in death. Now, admittedly, this was
37 happening before Tasers were implemented. In the
38 '80s with the cocaine era in Miami, there was a
39 string of these deaths and Tasers were not yet
40 implemented. But what's not known is whether or
41 not the risk has been increased with the addition
42 of the Taser.

43 Now, what's interesting is that there is this
44 innocuous sounding society called the Institute
45 for Prevention of In-Custody Deaths, and it turns
46 out to be a TASER-funded entity where they raise
47 awareness for this sudden death due to excited

1 delirium and they have TASER-paid speakers
2 presenting data to support that hypothesis. And I
3 mention these other issues here.

4 THE COMMISSIONER: Doctor, let me mention something
5 that's been advanced, namely that if one assumes
6 that there is a set of syndromes that you can
7 maybe call excited delirium, and you've described
8 those syndromes in your note here, and assume for
9 a moment that the Taser does not cause or
10 contribute, or if it does, the chances that it
11 does are very small. The theory goes on to say
12 that the person could die without intervention,
13 and you cannot have intervention without control
14 so he should be Tasered to get the control to have
15 intervention.

16 A I think that would be a hypothesis. That has to
17 be proven with data. Some of you may have read
18 the very nice editorial with tongue firmly in
19 cheek by Dr. Stanbrook in the *Canadian Medical*
20 *Association Journal*.

21 THE COMMISSIONER: Yes, very recently.

22 A And if TASER is advancing this as a treatment for
23 a medical condition, then it should be tested for
24 that indication in rigorous scientific tests and
25 not advanced as a claim. So I'd say the jury is
26 out. I admit that -- admittedly, these risks are
27 in absolute terms very low. It's true, I'm sure,
28 that Tasers are being used thousands of times a
29 day and we're not seeing people dropping dead
30 suddenly every day. There's about 300 or so
31 recorded sudden deaths in temporal proximity to
32 Taser, and so doing the math, it's quite low, the
33 risk. But what we don't know is has the Taser
34 increased that risk from that very low rate to a
35 slightly higher rate. We don't know that yet.

36 THE COMMISSIONER: And just to carry on with this for a
37 moment, because it is a major problem for me.
38 Would you -- I mean, you're probably coming to
39 recommendations. But from a policy point of view,
40 given the state of the knowledge, would you make
41 any statement as to the use of a Taser if that
42 syndrome --

43 A I will be coming to that, yes.

44 THE COMMISSIONER: Oh, all right. Thank you.

45 A So this is a nice segue into the fact that there
46 have been no studies to examine the true impact of
47 Tasers on real world outcomes of in-custody sudden

1 deaths. The data is there, I would say. Cities
2 are recording. Jurisdictions have this data. It
3 just needs to be released. Cities just need to be
4 transparent about releasing the information into
5 independent scientific hands for review.

6 So these are my conclusions from the data.
7 There is a low absolute risk for sudden death but
8 it's not non-lethal. I said earlier absolutely
9 it's not happening with an alarming frequency. It
10 is happening, though. There is a definitive risk
11 for both mechanisms of lethal arrhythmias in
12 animal models. Both VT and VF have been
13 demonstrated in animal models. There has now been
14 a definitive demonstration of myocardial capture
15 during Taser shock in humans with the subject with
16 the pacemaker. Adrenaline increases the
17 vulnerability for Taser-induced VT/VF. It's been
18 shown in the animal model by Dr. Nanthakumar.

19 Tolerability in healthy volunteers under
20 optimal conditions does not mean safety. Human
21 studies do not approximate the real world uses
22 with higher risk due to underlying heart disease,
23 multiple shocks, concomitant illicit drug use,
24 adrenaline, acidosis, or additive effect on this
25 debated condition, excited delirium.

26 The vector is critically important. Vector
27 across the heart, there is a risk for capture of
28 the heart. Vector anywhere else has almost zero
29 risk for capturing the heart.

30 If you see no finding on an autopsy, that
31 supports a related arrhythmic death. If there's a
32 person that dropped dead suddenly after Taser
33 application and you can find nothing else on
34 autopsy, I would venture to say that that's due to
35 an arrhythmic death.

36 A finding of an underlying cardiac disease
37 does not exclude the Taser. So just because you
38 see evidence of a heart attack doesn't mean that
39 the Taser didn't contribute to having that heart
40 attack, say for example. It doesn't prove that it
41 was the cause, but I would say that it doesn't
42 exclude it as a contributory cause.

43 If you have a temporal association, a sudden
44 collapse right after the Taser, that almost
45 certainly means that the Taser induced a
46 ventricular arrhythmia. I don't have access to
47 these autopsy reports to know with what frequency

1 this is happening, but if you have a description
2 of that kind of a scenario, then it's got to be
3 due to an arrhythmic death.

4 Also I'll say that delayed sudden death
5 doesn't mean that the Taser shock was not
6 contributory. You've seen that the Taser causes
7 QT changes. It causes acidosis. It causes pain
8 and adrenaline. And those effects persist for
9 minutes. So if you have a sudden death ten
10 minutes later, twenty minutes later, that doesn't
11 mean that the Taser twenty minutes ago didn't
12 contribute to that death.

13 So these are my recommendations, if you will
14 allow me to editorialize. These are my opinions.

15 In terms of research, there are very definite
16 open questions of the true effect on outcomes of
17 in-custody sudden deaths and the additive risk, if
18 any, for excited delirium deaths by Tasers in the
19 real world setting. And I'd say that the data is
20 there. We just need to get it. We can do all the
21 theoretical calculations and experimental studies
22 we can think of in healthy volunteers shot in the
23 back and anaesthetized pigs, but we can't know the
24 answer until we examine real world outcomes.

25 Cities and jurisdictions should be
26 transparent with outcome statistics for expert
27 review in an objective and scientific manner.

28 In terms of policy -- I'm a physician and not
29 a policy-maker, but these would be my
30 recommendations. There may be a useful role for
31 Tasers in law enforcement. I have utmost respect
32 for law enforcement who face risks every day.
33 There may be a useful role for Tasers. It's not
34 my place to decide that. However, the public
35 should be aware of the Taser risks, and policy
36 should be crafted with knowledge of these risks.

37 Due to the direct and additive risk for
38 lethal events, Tasers should only be deployed in
39 situations in which subjects are an imminent
40 threat of significant harm to themselves or to
41 others, in my opinion.

42 Avoid vector across the chest. I think if
43 police agencies were taught to avoid Taser-ing the
44 chest, then these Taser-related deaths may go
45 down.

46 Avoiding repeated shocks. So as I showed
47 you, the possibility of capture of the heart. Any

Dr. Zian Tseng (Medical presenter)
Questions by Mr. Vertlieb (cont'd)

1 time you have a finger on the trigger and the
2 optimal vector across the heart, you may be
3 capturing the heart and causing no cardiac output.
4 Repeated shocks increase this risk of ventricular
5 arrhythmias.

6 And in my opinion, we should mandate AED
7 availability with any Taser. We have the antidote
8 available. An AED can resuscitate somebody from
9 ventricular fibrillation. So if a policy agency
10 mandates that AEDs are in the trunk of their cars
11 when they're using Tasers, if somebody drops dead
12 suddenly they can pull out the AED and potentially
13 resuscitate that suspect.

14 Thanks for your attention.

15 THE COMMISSIONER: Doctor, thank you very much. We'll
16 have a break so that counsel can reflect on this.
17 Ten minutes.

18
19 (PRESENTER STOOD DOWN)

20
21 (PROCEEDINGS ADJOURNED)

22 (PROCEEDINGS RESUMED)

23
24 DR. ZIAN TSENG, a Medical
25 presenter, resumed.

26
27 THE COMMISSIONER: All right, I understand we're ready
28 to commence. Yes, counsel.

29 MR. VERTLIEB: Thank you, Mr. Commissioner.

30
31 QUESTIONS BY MR. VERTLIEB, continuing:

32
33 Q Dr. Tseng, the word "capture," if you're talking
34 about that with a patient, for example, how is
35 another way to explain that?

36 A Capture of the heart would be overtaking the
37 heartbeat with an external electrical device.
38 It's something that I can do during my operations
39 where I purposefully pace the heart at whatever
40 rate that I control during an electrophysiology
41 procedure, or with a pacemaker, where I can
42 program the pacemaker to capture the heart at
43 different rates. So it's overriding the normal
44 heart rate and normal electrical conduction of the
45 heart with an external electrical pulse.

46 Q Now, to help us understand heartbeats, you
47 mentioned fibrillation and perhaps 300 flutters

- 1 per minute. Take someone who's going through an
2 extensive exercise regime and running and working
3 out. What would the maximum amount of heartbeat
4 per minute be when someone's undergone really
5 extensive, thorough exercise?
- 6 A The physiologic prediction of maximum heart rate
7 is 220 beats per minute minus your age. And
8 that's the absolute maximum for a typical person
9 their heart rate can go.
- 10 Q So if you took a 40-year-old man and he exercised
11 as hard as he could for an hour or an hour and a
12 half, the maximum heart rate would be about 180
13 beats per minute?
- 14 A Correct. Now, remember that the 180 beats per
15 minute is via the normal electrical system, normal
16 coordinated contraction at 180 beats per minute.
17 And that's -- contrast with capturing the heart
18 from an external position and causing an unnatural
19 contraction of the heart from that vector rather
20 than from the normal electrical system.
- 21 Q So now take the 180 with a 40-year-old man who's
22 been exercising vigorously, and then tell us how
23 the 300 per minute, why it's so significant to
24 you.
- 25 A So two reasons. Number one, 300 beats per minute
26 is, even in the normal electrical system, if it
27 could sustain that fast of a normal heartbeat,
28 would be almost certainly not -- you would almost
29 certainly not have any usable cardiac output from
30 a rhythm of 300 beats per minute even if it were
31 normal rhythm. Throw into that mix abnormal
32 rhythm, chaotic rhythm, at 300 beats per minute,
33 and the heart is essentially stopped and has no
34 cardiac output.
- 35 Q So it's beating so fast it's really doing nothing?
- 36 A Correct.
- 37 Q The number 300, is that a number that is in a
38 relevant way to ventricular fibrillation? Is this
39 where we're moving with the 300?
- 40 A I would say it's not an absolute number cut-off.
41 It's a rhythm diagnosis made on an EKG rhythm
42 strip.
- 43 Q You explained why VF needs to be defibrillated
44 because it will lead to death otherwise. Can the
45 tachycardia lead to death?
- 46 A Yes. Now, several caveats with ventricular
47 tachycardia is that it typically occurs only in

1 the setting of abnormal heart. Typically there's
2 a scar in the heart from a heart attack or from
3 heart failure or from disease of the electrical
4 system itself to allow for a ventricular
5 tachycardia. But ventricular tachycardia, as I
6 mentioned, is also a medical emergency because
7 it's a very fast rhythm in an uncoordinated
8 fashion that does not support -- or may not
9 support physiologic cardiac output. It's not zero
10 but it's much lower than the normal cardiac
11 output, and sustained ventricular tachycardia may
12 degenerate into ventricular fibrillation to lead
13 to death.

14 Q Now, you mentioned in one of the slides, you talk
15 about the vulnerable heart, and you went through
16 the factors that would make a heart vulnerable.
17 Vulnerable to what and why do those factors make
18 the heart vulnerable?

19 A Some of the -- there are a lot of biochemical and
20 physiologic effects of adrenaline or cocaine or
21 illicit drugs upon receptors in the heart that
22 make the repolarization or the cardiac membrane
23 itself more susceptible to ventricular
24 arrhythmias.

25 Q Why does the lowering of the pH have a bad
26 consequence for somebody, makes them more
27 vulnerable?

28 A The pH has a direct effect on adjusting the
29 resting membrane potential of cardiac tissues, and
30 that indirectly can affect vulnerability.

31 Q Is the size of the person a factor in terms of
32 large or small person?

33 A The pig studies that I presented demonstrate that
34 smaller body sizes are more prone to risk of
35 cardiac capture.

36 Q So if a smaller person is Tasered, do they have
37 more risk than someone who's much heavier?

38 A That would be the extrapolation that I would make.
39 However, these are animal studies and were not
40 human studies. I will also mention, though, that
41 smaller human volunteers were excluded from the
42 police studies, presumably because the ethical
43 review boards potentially recognized that risk.

44 THE COMMISSIONER: Yes. We've heard too that a smaller
45 person means that perhaps the electrical charge
46 emanating from the points has a shorter distance
47 to travel to get to the heart.

Dr. Zian Tseng (Medical presenter)
Questions by Mr. Vertlieb (cont'd)

- 1 A Correct.
- 2 MR. VERTLIEB:
- 3 Q Is a person with high blood pressure at more risk
4 from having these bad consequences?
- 5 A I wouldn't say directly, but high blood pressure
6 as a condition may be a sign of underlying heart
7 disease which would make somebody more at risk for
8 sudden death, or I should say at risk for a sudden
9 arrhythmia. So it's an extrapolation several
10 steps forward. But in the acute setting, in a
11 suspect who might be in a clash with police, the
12 high blood pressure is a sign of high adrenaline
13 in their system.
- 14 Q Now, in one of your slides, you mentioned about
15 the work of Dr. Ho and you've covered that. Is
16 Dr. Ho a cardiologist like yourself?
- 17 A I have never met Dr. Ho and I don't know him
18 personally, but I understand he is an emergency
19 physician in Minnesota.
- 20 Q Now, the Taser submission includes material from a
21 Dr. Kröll. Do you know that person?
- 22 A Dr. Kröll, I believe, is not a medical doctor.
23 He's a biomedical engineer who is on the Taser
24 board and has advanced a lot of the theoretical
25 constructs that Taser cannot capture the heart in
26 these mathematical models.
- 27 Q When you use the term "theoretical construct,"
28 what do you mean?
- 29 A As I mentioned before, these are mathematical
30 models and assumptions made based upon -- any time
31 you create a mathematical model, you need to make
32 assumptions in these equations. And so a lot of
33 the assumptions, there's room for interpretation
34 whether or not those assumptions are correct. And
35 so you make a small adjustment in one of those
36 assumptions and perhaps the mathematical model now
37 allows for Taser capture. And I think you can
38 have demonstration by theoretical models but that
39 doesn't refute that these animal studies have
40 shown capture.
- 41 Q So just so we understand, Dr. Webster --
42 THE COMMISSIONER: But the reality overcomes the
43 construct.
- 44 A Yes.
- 45 MR. VERTLIEB:
- 46 Q You've heard of a Dr. John Webster from the
47 University of Wisconsin and you've read some of

1 his material, and also a Mr. Pat Reilly, who's an
2 electrical engineer? You're familiar with their
3 work?

4 A I honestly am not as familiar with their work.
5 Q They would be constructs, though?
6 A As I understand it, yes.
7 Q You spoke quite a number of times about the
8 vector. Show us what you meant by that when you
9 say "vector."

10 A So these animal studies have shown -- the pig
11 models have shown critical dependence of ability
12 of myocardial capture by the vector of the Taser
13 barbs, so they need to be just so over the chest
14 in order to capture the heart. So a vector across
15 the abdomen does not capture the heart. A vector
16 in the back does not capture the heart. A vector
17 on the arm does not capture the heart. But a
18 vector just so on the body can capture the heart.
19 And I would say that that's a potential
20 explanation for why this is not happening with
21 greater frequency, because it has to be under this
22 worst case scenario where the Taser barbs have
23 captured over the heart for this to occur.

24 Q But even if someone was Tasered in the back or
25 abdomen, do you have a concern about increased
26 risk of a serious consequence to that person?

27 A I have a concern. These are my concerns. But I
28 would say that these are extrapolations from
29 research findings and not necessarily proof. But
30 acidosis has been shown after Taser shocks in the
31 back. And these ECG changes, we're not sure what
32 they mean, but they're there, have been shown with
33 Taser shocks in the back.

34 Q And what causes acidosis?

35 A Several things. Number one, with capture of the
36 skeletal muscles, the muscles that control your
37 arms and legs and breathing, the capture of those
38 muscles with the Taser repeatedly can induce
39 muscle damage, and the muscle damage itself can
40 lead to the acid condition.

41 Q So if someone is running, say, a 10-kilometre
42 race, would that affect their body chemistry in
43 the way you're talking?

44 A Certainly so. Yes.

45 Q So if you'd been in a state of a lot of exertion,
46 you'd been fighting or wrestling, would that
47 affect someone's levels the way you're talking?

- 1 A Yes. And it's definitely shown in marathon
2 runners, for example, that you can have acid
3 changes and muscle damage.
- 4 Q From the studies that have taken place with police
5 volunteers, we heard you discuss that they were
6 shot in the back or in an area not known. Was
7 there any indication, though, they had been
8 involved in strenuous activity, exercise, just
9 before they were shot with the Taser?
- 10 A In the majority of the studies I've read, either
11 subjects with high heart rates were excluded, or
12 if they had exercised, it was minutes to hours
13 before the Taser application.
- 14 Q What's the significance of that to you, in your
15 opinion?
- 16 A I think that we've seen that these studies in
17 total demonstrate a tolerability for Taser in
18 healthy, resting volunteers shot in the back, but
19 not in real world conditions.
- 20 Q Now, one of the people who was here before
21 mentioned a study from the NIJ. Are you familiar
22 with the NIJ? Just tell us about that.
- 23 A The National Institute of Justice is a branch of
24 the U.S. federal government which in May of 2006
25 commissioned a study looking at Taser-related
26 sudden deaths, and they're scheduled to be
27 releasing their results very soon.
- 28 Q And in terms of the people that were given the
29 Taser application, what do you know about who they
30 were or where the location of the Taser was?
- 31 A In the suspects that died, you're asking?
- 32 Q No, in the NIJ study.
- 33 A The NIJ study was the study that I mentioned that
34 was published by Vilke and Chan, and those studies
35 were all police volunteers who were shot in the
36 back.
- 37 Q And what about the size of the people?
- 38 A The methods in one of the studies describes
39 excluding anybody with smaller body sizes.
- 40 Q And what about any heart issues?
- 41 A In that study these were healthy subjects.
42 Anybody with any heart conditions was excluded.
43 However, one of the other studies did include a
44 small subset of police volunteers that did have
45 underlying previous cardiac conditions. I think
46 the incidence there was about 20 percent. But
47 these subjects, again, were shot in the back.

1 Q You mentioned the autopsy reports. Tell us why
2 you have the opinion you gave the Commissioner
3 about the autopsy, and why do you come to that
4 conclusion?

5 A An electrical death can only be proven with a real
6 time EKG at the time of the death. So at autopsy,
7 with no electrical activity, you won't see the
8 actual cause of the death. So in my opinion, if
9 there is no finding on autopsy to explain the
10 death, then it had to have been an arrhythmic
11 death.

12 Q Do you distinguish between the M26 and X26 Tasers
13 as being able to cause or contribute to VF?

14 A In the Nanthakumar study, he describes that the
15 X26 has a higher risk of myocardial capture than
16 the M26.

17 Q Meaning?

18 A Meaning that current differences, voltage
19 differences, electrical setting differences
20 between the two devices are such that the X26 has
21 a higher risk of myocardial capture.

22 Q What's your impression of the Nanthakumar-Dorian
23 study from the University of Toronto?

24 A I think that's a seminal study, as I mentioned in
25 my presentation. He was the first one to
26 demonstrate myocardial capture in a pig model,
27 admittedly anaesthetized pigs, of course, using
28 actual Taser weapons rather than simulated Taser
29 weapons in the other pig studies, which were
30 funded by Taser. And as I mentioned, a discovery
31 is only important if it can be replicated, and it
32 was replicated twice by a second group.

33 THE COMMISSIONER: And themselves.

34 A Correct.

35 MR. VERTLIEB:

36 Q How significant to your opinion is the pacemaker
37 case you mentioned?

38 A So I want to give a balanced critique of that
39 study. On the one hand, it demonstrates in a
40 human for the first time that the Taser can
41 capture the heart. The conundrum, as I mentioned,
42 is that in any other study, as you saw with the
43 police volunteers, an external EKG signal is going
44 to be overwhelmed by the Taser electrical, so you
45 don't know what's going on underneath the Taser
46 electrical signal, whether the heart can be
47 captured or is being captured. So the only way to

1 confirm that would be something that's already
2 inside the heart with the ability to record the
3 rhythm at the time of the Taser application. So
4 this study -- it was not even a study. It was a
5 case report. It was a report of a single patient
6 with a pacemaker that got Tasered and
7 demonstrating that the pacemaker confirmed capture
8 of the heart during the Taser application.

9 So the critique of that would be that perhaps
10 you can only capture the heart with in-dwelling
11 wires in the heart. That may allow for a vector
12 of current to be that much easier to go into the
13 heart with the wires inside the heart. So
14 perhaps -- I think one conclusion in extrapolation
15 is that this is certainly a high risk for patients
16 with pacemakers and we don't know in humans if, in
17 the absence of a pacemaker, that you can capture
18 the heart.

19 Q And that person happened to be Tasered by the
20 police?

21 A Correct.

22 Q It wasn't a laboratory experiment?

23 A No. Real world conditions, exactly.

24 Q So when you talk about the heart cycle and the
25 timing and all the way it works, is some of this
26 the luck of the draw, that if the Taser happens to
27 catch you at the wrong moment in the heartbeat?

28 A In my opinion, it has to be a worst case scenario.
29 You had to have had the Taser barbs in just the
30 right configuration. The suspect had to have been
31 clashing with police, with high adrenaline,
32 typically with cocaine in their system,
33 methamphetamines. So the conditions have to be
34 just right for this to occur. But in my opinion,
35 there is definitely that risk.

36 THE COMMISSIONER: I'm afraid, Doctor, that I have to
37 come back to this because, as you can see, it's
38 troubling me, particularly after some -- there was
39 a presentation to us by people representing those
40 that are disabled. When you have this group of
41 syndromes that we call excited delirium, part of
42 this syndrome package relates to extraordinary
43 strength and other things. Now, ideally of
44 course, there would be a talking down or other
45 such techniques. Now, I suppose the ideal
46 situation, but you correct me, would be that if
47 you could somehow get a defibrillator there pretty

Dr. Zian Tseng (Medical presenter)
Questions by Mr. Vertlieb (cont'd)

1 fast, then Taser the fellow, or the person?
2 A I think there is a role for Taser most likely. In
3 conditions in which you might otherwise resort to
4 lethal force, I think obviously the Taser is a
5 feasible option. If such a scenario existed and
6 there were no other options, that may be a certain
7 scenario where the Taser would be helpful or
8 possibly helpful. And I would recommend in that
9 case exactly as you mentioned, to have an AED
10 available and also to avoid Tasering the chest.
11 THE COMMISSIONER: Thank you.
12 MR. VERTLIEB:
13 Q What's the cost of an AED?
14 A I think you can find it on Amazon for about \$1,200
15 or so.
16 THE COMMISSIONER: The same price as a Taser?
17 A I don't know how much Tasers are going these days,
18 but probably around the same order, yes.
19 MR. VERTLIEB:
20 Q Has any police agency in Canada asked you to come
21 and present the way we've asked you to come and
22 present here?
23 A No.
24 Q Would you be available if a police agency in this
25 country wanted to have you present as you've done
26 here today?
27 A I'm happy to make this presentation available, and
28 if my schedule allows, I would certainly be open
29 to presenting.
30 Q And is this an area that you're involved in
31 ongoing research on as we speak today?
32 A I will mention that what I've presented today is
33 a summary of others' research findings and not my
34 own. In the process of learning more about the
35 Taser and becoming familiar with the literature,
36 a colleague of mine and I have begun to look into
37 some of these real world outcomes of Taser
38 application in the field, and we're analyzing our
39 data right now.
40 THE COMMISSIONER: I guess to say the obvious,
41 obviously you haven't found anything to contradict
42 your presentation?
43 A I cannot comment on our findings yet.
44 THE COMMISSIONER: Okay.
45 MR. VERTLIEB: Dr. Tseng, thank you so much for
46 agreeing to come here at our request, and we're
47 very obliged to you for being here.

Paul Corrado (Law enforcement presenter)
Questions by Mr. McGowan

1 THE COMMISSIONER: Doctor, I might say that that was a
2 very clear and complete exposition of a very
3 complicated matter, and we're very much in your
4 debt. Thank you.

5 A My pleasure.

6

7

(PRESENTER EXCUSED)

8

9

THE COMMISSIONER: That's all for today?

10

MR. VERTLIEB: No. Mr. Commissioner, we have Mr.
11 Corrado from the Sheriff Services who will be able
12 to present now. The presentation with Dr. Tseng
13 went a bit -- there was more material than we had
14 planned. We had hoped to have someone else this
15 morning as well for 12:15 other than Mr. Corrado
16 and I think that won't be probable. So we'll
17 finish Mr. Corrado.

18

I can tell you, just while we're on this,
19 that for Monday we have Mr. Tom Smith, the
20 Chairman of the Board, for Monday morning.

21

THE COMMISSIONER: Chairman of the Board of TASER?

22

MR. VERTLIEB: Of TASER, yes. He's asked to come here
23 and we've of course met his request. And we've
24 asked, Monday afternoon, for the former Attorney
25 General, Ujjal Dosanjh, to come and he has met our
26 request and he will be here Monday afternoon at
27 1:30. So we can either take a quick break with
28 you now for Mr. Corrado and allow Dr. Tseng to
29 close his materials et cetera, or just take a few
30 minutes. Whatever you wish.

31

THE COMMISSIONER: Just a five-minute break.

32

33

(PROCEEDINGS ADJOURNED)

34

(PROCEEDINGS RECONVENED)

35

36

PAUL CORRADO, a Law
enforcement presenter.

37

38

39

THE COMMISSIONER: I understand that we can recommence.
40 Yes, counsel.

41

MR. MCGOWAN: Thank you, Mr. Commissioner.

42

THE COMMISSIONER: Can we have a little silence,
43 please, gentlemen.

44

MR. MCGOWAN: Mr. Commissioner, the next presenter is
45 Superintendent Paul Corrado. He is the
46 Superintendent, Strategic Security Operations, for
47 the Sheriff Services in British Columbia. Sitting

Paul Corrado (Law enforcement presenter)
Questions by Mr. McGowan

1 with him is Greg Ducharme, Senior Use of Force
2 Instructor for the Sheriffs. Superintendent
3 Corrado will be making the presentation and
4 Mr. Ducharme is in attendance to assist with any
5 questions if necessary. Also in attendance is
6 Wayne Willows, who is here for support if
7 necessary, and he has a position --

8 THE COMMISSIONER: Thank you very much, gentlemen.

9

10 QUESTIONS BY MR. MCGOWAN:

11

12 Q I'll just spend a few minutes before we get
13 started -- is it Superintendent Corrado?

14 A Yes, it is.

15 Q -- introducing you to the Commissioner and
16 spending a few minutes going through your
17 background and experience.

18 A Of course.

19 Q You were born in Vancouver where you also grew up?

20 A Yes.

21 Q Completed your high school in the Vancouver area?

22 A That's correct.

23 Q Following which you attended Langara College in
24 the Criminal Justice Program for three years?

25 A Correct.

26 Q After that you joined the Sheriff Services in
27 1988?

28 A That's correct.

29 Q And you've been continuously employed by that
30 service until today?

31 A Yes.

32 Q You started as a line deputy sheriff?

33 A That's correct, Mr. Commissioner.

34 Q And perhaps you could just spend a minute or two
35 tracing your professional career with the Sheriff
36 Services for the Commissioner.

37 A Sure, I'd love to. I started in 1988 as a line
38 deputy and I've worked at various court locations
39 throughout that time. I was exposed to different
40 opportunities and I became a sergeant -- staff
41 sergeant at certain court locations in the Lower
42 Mainland. I did start special projects and I
43 started working throughout the branch on special
44 court events, such as our high profile/high
45 security matters. And in 2003 we started a new
46 unit within Sheriff Services. It's called the
47 Threat Assessment Unit, and that is where I became

1 the Superintendent. And what we do there is we
2 investigate and do assessments on threats and
3 inappropriate communication to our judiciary as
4 well as prosecutors.

5 Q Thank you, Superintendent. I wonder if you'd just
6 spend a moment discussing with the Commissioner
7 what the sheriffs in the province of British
8 Columbia do. What are their tasks? What role do
9 they fill?

10 A Well, if it would please the Commissioner, what
11 I'd like to do is read a statement that comes out
12 and explains exactly what the sheriffs are
13 responsible for.

14 Q Please. I'd invite you to do so now.

15

16 PRESENTATION BY MR. CORRADO:

17

18 A British Columbia Sheriff Services is a division of
19 Court Services Branch of the Ministry of Attorney
20 General, and the Sheriff Services are responsible
21 to include transporting prisoners, providing
22 courtroom security, assembling and supervising
23 juries, serving court documents, and carrying out
24 court orders.

25 Sheriff Services introduced the M26 Taser in
26 2001 and continue to use that model exclusively.
27 Tasers are used by Sheriff Services to assist in
28 prisoner management in cells and prisoner
29 transport and as an alternative force option
30 available to court security and rover teams, which
31 are court patrol officers at various courthouses.

32 Taser use is governed by a written policy
33 that permits the Taser to be used as a control
34 weapon against active resisters or assailants
35 where other forms of control or weapons would be
36 ineffective or inappropriate under the
37 circumstances. The policy has been in place since
38 the introduction of Tasers to Sheriff Services and
39 provides sheriff's officers with clear, explicit
40 guidelines and accountabilities with respect to
41 issuance and deployment of Tasers.

42 Strict reporting and record keeping is also
43 maintained and includes a central database that
44 tracks all Taser issue and deployment. Tasers are
45 not routinely carried by Sheriff Services officers
46 and are issued under strong controls only to
47 officers who have been certified in Taser use.

Paul Corrado (Law enforcement presenter)
Presentation
Questions by Mr. McGowan (cont'd)

1 Issuance is based on the need to provide the
2 level of safety and deterrence and effectiveness
3 provided by the Taser. This might, for example,
4 include the transportation of known violent and
5 repeat offenders.

6 Whenever a Taser is drawn or discharged as an
7 action to control a subject, a Taser deployment
8 report form is submitted to the deputy's immediate
9 supervisor as soon as possible. The Taser
10 deployment report must also be submitted to the
11 Director of Strategic Management and Corporate
12 Programs in Victoria within 24 hours of the
13 deployment. All reports are reviewed to ensure
14 deployment was in accordance with branch policy.

15 The use of the Taser is taught as part of
16 Sheriff Services' force options curriculum, which
17 is mandatory training provided to every deputy in
18 the province. Sheriff Services' force options
19 training is seven days at the recruit level and
20 covers decision-making and use of force levels and
21 incorporating all approved use of force tools, for
22 example stuns, strikes, control holds, pressure
23 areas, baton, OC spray, Taser, firearms and
24 handcuffs, et cetera.

25 Court Services Branch's use of force training
26 is based on international best practices and
27 industry standards in the area. All use of force
28 instructors are certified by the branch and the
29 Justice Institute of British Columbia. Follow-up
30 training on the Taser is done as part of the two-
31 year force options recertification process, which
32 is required under branch policy. So all our
33 deputies are required to certify in the use of
34 force and it's for a period of two years.

35 MR. MCGOWAN: Thank you. Is that the extent of the
36 oral presentation?

37 A It is.

38 MR. MCGOWAN: Thank you, Superintendent. I do have a
39 few questions and maybe we can just through those
40 right now, Mr. Commissioner, if that suits you.

41 THE COMMISSIONER: Yes, that's fine. Go ahead.

42
43 QUESTIONS BY MR. MCGOWAN, continuing:

44
45 Q What year was the Taser introduced in Sheriff
46 Services?

47 A 2001.

- 1 Q Do you know what process of review, if any, was
2 undertaken by Sheriff Services of the weapon and
3 its safety and efficacy prior to its introduction?
4 A No, I don't.
5 Q Approximately how many sheriffs are there in the
6 province of British Columbia?
7 A Approximately, Mr. Commissioner, we have close to
8 500.
9 Q And the number of Tasers?
10 A To date we're at 104.
11 Q Now, I understand you have rather strict sign-out
12 procedures and tracking procedures for the Taser;
13 is that correct?
14 A That's correct.
15 Q I wonder if you'd take a moment and just explain
16 those to the Commissioner.
17 A At the start of every shift, of an officer's
18 shift, they are to sign out the dedicated Taser.
19 There's a sign-in and sign-out log that in order
20 for them to carry that particular Taser for their
21 duties of that day, they need to sign out and then
22 sign in at the end of their shift.
23 Q Cartridges that go with the Taser, how are they
24 tracked?
25 A All cartridges and all our equipment are supplied
26 by our headquarters in Victoria, and if we have a
27 Taser deployment where we actually have the probes
28 that are discharged, in order to get a replacement
29 cartridge, you would have to complete the Taser
30 deployment form critical incident reports and
31 submit that to Victoria, and then you would be
32 able to get your replacement cartridge.
33 Q You're familiar with the national use of force
34 model, the wheel it's sometimes called, the
35 circle?
36 A Yes, I am.
37 Q In the Sheriff's policy respecting the use of
38 Tasers, where does the Taser fall?
39 A It falls the same as other police agencies or
40 other law enforcement agencies that we have and
41 it's at the active resister.
42 Q So passive resistance, the Taser is not allowed?
43 A No.
44 Q Any level of active resistance, it is permitted
45 according to your policy?
46 A It is, but we tend to use the Taser, from the
47 reports that I've seen, we use it for aggressive,

1 combative individuals.

2 Q Except in unusual circumstances, does approval
3 have to be sought prior to deploying the Taser?

4 A Yes. The Tasers in our cell block or holding
5 cells area are all secured, and you would need the
6 approval of a supervisor to actually get the
7 Taser.

8 Q I wonder if you'd describe for the Commissioner a
9 typical scenario in which sheriffs are today using
10 the Taser.

11 A I can explain a situation that happened up in
12 the -- most of our Taser deployments, I'd like
13 just to say from the outset, are as a deterrence.
14 If you note the information that we supplied on
15 our statistics, we've had very little deployments
16 of the Tasers, but a lot of it has been from our
17 Taser warnings to our showing of the Taser to
18 actually our laser sight activation, that's where
19 we've had to -- we actually stop when we end up
20 having control and compliance from a subject. So
21 we really haven't used the Taser as much as other
22 agencies have since 2001.

23 But an example of where we used it was up in
24 the Sunshine Coast at a courthouse there was an
25 individual that was appearing before a judge, and
26 I'm not sure of the whole particular details, but
27 he was ordered to remain in custody. He was
28 appearing from out of custody and he was detained
29 that particular day, and he became very aggressive
30 and started fighting with the particular deputy.
31 Backup was called and there was three police
32 officers and two deputy sheriffs that were trying
33 to subdue the individual, and they were having a
34 lot of trouble doing that. There was a third
35 officer that appeared with a Taser. He warned the
36 individual. The individual continued to fight
37 with officers and subsequently he was Tasered by
38 stun mode, and that was enough for the officers to
39 apply the restraints and control the individual.

40 THE COMMISSIONER: Any idea where on the person the
41 stun mode was operative?

42 A Mr. Commissioner, I believe that was in the back
43 or the leg.

44 THE COMMISSIONER: Thank you.

45 MR. MCGOWAN:

46 Q What's your definition of active resistance?

47 A Active resistance is an individual -- if I would

1 give an example of somebody who is in a cell and
2 he is holding onto the cell bars or he's - I think
3 the terminology that some agencies are using is
4 turtling - he's not complying with the demands
5 that are asked of him.

6 Q Let me give you a scenario and see if this is a
7 situation in which, regardless of what your policy
8 says, in practice the Taser would be authorized.
9 An individual --

10 THE COMMISSIONER: Just a minute. And that would be in
11 stun mode?

12 A I'm sorry, Mr. Commissioner?

13 THE COMMISSIONER: Holding onto the bars and not
14 complying, would that be in stun mode?

15 A That we would deploy the Taser?

16 THE COMMISSIONER: Yes.

17 A I'm not saying that we would deploy the Taser at
18 that time. I'm just explaining what active
19 resister would be.

20 THE COMMISSIONER: Oh, all right.

21 MR. MCGOWAN:

22 Q Superintendent Corrado, that's where I'm heading
23 with my question. The scenario you just gave us,
24 a subject is in the cell hanging onto the sink or
25 the bars in the cell, you've instructed him to
26 move, he hasn't done so but he's not posing a risk
27 to anybody else. Is that a circumstance in which
28 Sheriff Services is using the Taser or is not
29 using the Taser?

30 A No, we wouldn't use the Taser in that situation.

31 Q Do I understand from what you've said that Taser
32 is only being authorized in circumstances where
33 somebody is being assaultive or violent?

34 A That's correct.

35 Q So this part of your policy, the active resistance
36 portion of your policy, that's not something that
37 you're utilizing?

38 A It isn't.

39 Q And you're not experiencing difficulties with
40 respect to the safety of your sheriffs because of
41 the way you've interpreted Taser use?

42 A No. No.

43 Q You've given us some numbers here and they're
44 quite interesting, so I'm just going to take you
45 to them for the benefit of the Commission.

46 A Certainly.

47 Q The Taser, I understand from the sheet you've

- 1 provided me, has been authorized for use 132
2 times?
- 3 A That's correct.
- 4 Q It's been deployed on a subject -- of those 132
5 times, only 25 of those resulted in actual
6 deployment of the Taser?
- 7 A That's correct.
- 8 Q Now, your numbers reference, of those 132, 114 of
9 them related to jail security events.
- 10 A That's correct, Mr. Commissioner.
- 11 Q What were the remainder?
- 12 A They could have been outside of the jail setting.
- 13 Q Okay. And I see that --
- 14 A Within the court confines.
- 15 Q I see a reference here, which you in a forthright
16 manner highlighted in boldface, of 54 accidental
17 discharges. I wonder if you might just explain
18 that number.
- 19 A Certainly. Maybe accidental discharges is the
20 wrong terminology that's used. But we've had 54 -
21 I'll use the terminology that I have here -
22 accidental discharges since 2001. And what those
23 are is -- I might say that I think we are the only
24 agency that records this. At the beginning of
25 each shift of an officer, when he is -- we call it
26 function testing. I think throughout the days
27 you've heard "arced" --
- 28 THE COMMISSIONER: Sparking.
- 29 A Sparking. We call it function testing. So when a
30 deputy starts his shift and he does the function
31 test, this is done in an armoury. Each courthouse
32 has an armoury and that's where we store our
33 weapons. They do a function test in this steel
34 barrel loading station, as we call it, and what
35 happens is, I'm led to believe that the cartridge
36 is left in the Taser, so when they're doing their
37 function test, the accidental discharge happens
38 that the cartridge is released into the -- in the
39 loading drum.
- 40 MR. MCGOWAN:
- 41 Q And where do you do your spark test at the
42 beginning of the shift?
- 43 A All our spark tests are done in the armoury in a
44 closed, confined area, and that's where we store
45 all our weapons.
- 46 Q The sheriffs provide their own training for Taser
47 certification of their deputies?

- 1 A That's correct. It's done by the Justice
2 Institute of British Columbia.
- 3 Q During the training, what are the deputies told
4 regarding the safety of the Taser weapon?
- 5 A I'm not sure that they're told anything about the
6 safety of it itself.
- 7 Q Is the view taken in the training process and the
8 way the training is set up that the weapon poses
9 no safety risk?
- 10 A Yes. That's what we're led to believe, yes.
- 11 Q What source has led you to believe that?
- 12 A The manufacturer, TASER International.
- 13 Q Thank you, Superintendent. I understand that
14 there is software available to download data from
15 the Taser device. Is that software which Sheriff
16 Services possesses?
- 17 A Yes, we do have that.
- 18 Q And is the information downloaded from the Tasers?
- 19 A It is, every deployment.
- 20 Q Has Sheriff Services compiled any statistics
21 regarding the impact or lack of impact on officer
22 safety or injuries to subjects as a result of the
23 implementation of the Taser in British Columbia?
- 24 A We don't have that statistic, but most of -- like
25 I said earlier, most of our deployments have been
26 to the point where we haven't had to deploy the
27 actual Taser, and we've noticed through reports,
28 through Workers' Compensation applications, a
29 reduced amount of those where we've had officer
30 injury.
- 31 Q Have you compiled any statistics with respect to
32 the Workers' Compensation or is that just
33 something you have a feel for?
- 34 A That's something I have a feel for.
- 35 Q Now, Superintendent Corrado, I note in your policy
36 that there seems to be a real emphasis on avoiding
37 the use of the Taser in contact stun mode. What
38 do you have to say about that?
- 39 A I'm not sure that we both understand the question.
- 40 Q I'm looking at your policy. It's titled "B.C.
41 Sheriff Taser Policy" and on the second page,
42 provision 4.5.4, it says:
- 43
- 44 Use of the Taser in contact stun mode shall
45 only take place where the subject is
46 continuing to resist and the probes have been
47 discharged or malfunctioned and reloading is

1 not possible or a physical situation
2 restricts use of the probes.
3

4 I'd be happy to show you my copy if that would
5 assist you.

6 A Yes, please.

7 MR. DUCHARME: The definition -- sorry, sir. My name
8 is Greg Ducharme.

9 THE COMMISSIONER: Yes, go ahead.

10 MR. DUCHARME: The definition of contact stun mode is
11 that there either isn't a cartridge on the end of
12 the Taser or that the probes have been deployed,
13 so just definition-wise, if you're going to do a
14 contact stun mode, it has to be without a
15 cartridge or only if the probes have already been
16 deployed. So it's a policy just in that you
17 either have a full deployment where the probes
18 come out of the Taser, which is a probe
19 deployment, or you have a contact stun mode. So
20 it's just a differentiation between the two
21 different types of control modes.

22 THE COMMISSIONER: But as I understand from your
23 presentation earlier, usually when a sheriff's
24 officer uses it, you do use it in stun mode.

25 A (MR. CORRADO) There have been times that we've
26 used it, and that's nine times since 2001 we've
27 used it in contact stun mode.

28 MR. MCGOWAN:

29 Q And that's 16 times in probe mode?

30 A That's correct.

31 MR. DUCHARME: The difference between the contact stun
32 mode and the actual probe deployment can depend on
33 the actual individual circumstances of the
34 incident. So it just depends on what type of
35 incident you have, the distance between the
36 officer and the subject at the time.

37 Q So you don't read your policy as preferring the
38 probe mode over the stun mode?

39 MR. DUCHARME: No, it's more regarding tactics and
40 safety around the actual use.

41 MR. MCGOWAN: Those are my questions, Mr. Commissioner.

42 THE COMMISSIONER: Thank you very much for taking the
43 time to come. We very much appreciate your
44 presence here. Thank you.

45
46
47

(PRESENTER EXCUSED)

Kenneth J. Stethem (Interested groups and individuals
presenter)
Presentation

1 MR. VERTLIEB: Mr. Commissioner, we were hoping to get
2 Mr. Stethem in, who is requesting 15 minutes, but
3 as things often happen, that may be a bit short on
4 estimate. So rather than start somebody now, I'm
5 thinking that we just may want to break for the
6 day and we'll rearrange Mr. Stethem. Now, he is
7 here, if he wants to start.

8 THE COMMISSIONER: Where is Mr. Stethem?

9 MR. VERTLIEB: Well, he's certainly around. Do you
10 want --

11 THE COMMISSIONER: Why don't we take a moment to speak
12 with him.

13 MR. VERTLIEB: Okay. Thank you, sir.

14

15 (PROCEEDINGS ADJOURNED)

16

16 (PROCEEDINGS RECONVENED)

17

18 THE COMMISSIONER: I believe we can commence.

19

MR. VERTLIEB: I know that your time is precious here,
20 Mr. Stethem. Let's just turn it over to you.

21

21 Give us your background. It will come out in your
22 presentation, I think.

22

23

24

KENNETH J. STETHEM, Interested
25 groups and individuals
26 presenter.

27

28

PRESENTATION BY MR. STETHEM:

29

30

A Thank you, Your Honour, very much. And I want to
31 thank the inquiry for the opportunity to present
32 today.

33

33 My name is Ken Stethem and I'm here both as a
34 citizen of the United States and a friend of
35 Canada and also as a industry player in this
36 industry. And like many citizens, I have
37 questions and concerns regarding the safety and
38 the appropriate use of stun devices. But as a
39 manufacturer and a designer/developer of these
40 devices, I also have some information that I think
41 is very pertinent to safety and the appropriate
42 use of these devices.

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43 This presentation is going to focus on
44 appropriate use. Before I start I'd like to
45 disclose (a) that I am the founder, chairman and
46 CEO of an industry player. I have no financial
47 interest in any other company in this industry

44

45

46

47

Kenneth J. Stethem (Interested groups and individuals
presenter)
Presentation

1 except my own. We are an industry player. We
2 have done research and we're on the leading edge
3 in different types of research in this industry.

4 Some of the initiatives we've had - and you
5 can see it goes back to 2005-2006 - we were the
6 first company in this industry to host national
7 and international studies, forums and conferences
8 regarding neuromuscular incapacitation devices.

9 Research in strategic and study partners and
10 participants that we have include the Harvard-MIT
11 Health Science Technology. Everybody knows
12 Harvard-MIT by reputation. Kansas City Plant is a
13 Department of Energy and Honeywell facility. It's
14 80 acres under one roof and they're one of the
15 premier limited design and development
16 institutions in the world. The Joint Non-Lethal
17 Directorate has attended our meetings at the
18 Potomac Policy Institute in DC and a couple of
19 other industry players have not only participated
20 in our conferences, they've also presented,
21 including TASER and Defense Technologies. And the
22 Target Behavioral Research Lab with the Army,
23 we've got a research and development contract with
24 them and we've presented to Bioelectric Magnetic
25 Society, which is an international institute
26 dealing with these matters. And I only say this
27 to give credibility from where I'm coming from.

28 This is an information presentation. We're
29 going to define appropriate use. We're going to
30 identify essential elements of information that
31 you need in order to find, develop and deploy
32 conducted electrical weapons. Then we're going to
33 do an objective analysis of the industry now and
34 provide recommendations and conclusions.

35 Our definition for appropriate use is the
36 proper deployment of conducted electrical weapons
37 within thresholds of safety and effectiveness that
38 have been identified through scientifically-based
39 medical, electrical and operational research.
40 Appropriate use requires that this research be
41 independently peer-reviewed, published, and widely
42 accepted.

43 The essential elements of information. This
44 really isn't that hard. That's the definition.
45 What do you need to get to that definition? You
46 need medical safety data. You need electrical
47 safety data. You need to take that information

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1 and try it out after animals on humans at a Target
2 Behavioral Response lab. And then you can do a
3 human effects risk characterization on the
4 technology.

5 So if you look at the bottom, there's what
6 you need to start. When you get those four groups
7 of information done, you can define appropriate
8 use. Now you've got medical and scientific
9 standards to define it, and then you can develop
10 your use of force parameters and develop your use
11 of force policies.

12 In my humble opinion, that's not how the
13 current CEWs were developed and deployed, and
14 that's why we're having problems today.

15 This just isn't my own personal opinion.
16 This is a quote from Lieutenant Colonel Mark
17 Wroble, the human effects officer at the DOD, U.S.
18 Department of Defense Joint Non-lethal
19 Directorate. And he said: "Understanding the
20 human effects of non-lethal technology is
21 fundamental to their development." And the reason
22 for that, you need the thresholds for safety and
23 effectiveness. "Both the effects and the
24 effectiveness must be clearly understood." He
25 even developed a human effects readiness level
26 guide for the technology. It starts at zero and
27 ends at nine and it includes those four steps that
28 I mentioned earlier. And this is the model that I
29 think, the methodology to rolling this technology
30 out, to limit the issues.

31 So objective analysis. The first one we're
32 going to do is on medical. This is from TASER's
33 website, and I went to TASER's website because
34 they've been around probably the longest. You can
35 see it's 2002. There's the reference. And Your
36 Honour, you've going to see a lot of information
37 today. It's all going to be referenced, and if
38 it's not, I'll point it out. That's from TASER's
39 archive website. That's the year. This is the
40 science that they had done in 2002. And I want
41 you to look close because you can go down those
42 eight things - actually it's seven - and very few
43 actually apply to the M26, which was deployed in
44 1999.

45 If you look under that line, it says: "While
46 all the field studies to date have been conducted
47 with 7-Watt systems..." That's the low power. In

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1 1999, the 26 power was introduced, 26-Watt system.
2 It says: "...the pre-release testing of the
3 Advanced Taser on both human and animal subjects
4 indicates that the Advanced Taser's enhanced EMD
5 output also leaves no lasting effect." Okay. And
6 that's, again, the TASER website. What that says
7 is that their studies above were done on the
8 7-Watt system, not the M26, and that was three
9 years after the system was deployed.

10 And mind you, I'm not here to bang TASER
11 International or anybody else. I'm here just to
12 report what we learned through our research and
13 development.

14 Again, medical. We're going to go over a
15 couple of studies that I feel are very revealing
16 and very pertinent. And the reason they're
17 pertinent is because they address VF and acidosis,
18 which are probably the two major medical issues
19 with this technology.

20 Medical. Thresholds for VF. This is in this
21 manual. This is a medical examiners' manual.
22 It's recognized. MEs are taught from that manual.
23 "Low voltage electrocutions from household current
24 may occur without any visible evidence of injury."
25 Part of the reason there is no evidence of a Taser
26 cause, in my humble opinion, is the fact that low
27 power electrocutions don't leave any evidence. So
28 now the burden of proof has been shifted to the
29 public that these aren't safe instead of law
30 enforcement and the manufacturers that they are.
31 And this is a very important thing: "Fatal heart
32 arrhythmias disturbances may result from AC
33 currents as low" -- hmm -- as that amp, 100
34 milliamps. Why is that pertinent?

35 This is another manual right next -- "VF
36 occurs at currents between 75 and 100 milliamps."
37 Why is that threshold, that number, so important?
38 And you'll see. In just a moment you'll see.

39 If you look -- this is a Sticky Shocker
40 report that was done and available to law
41 enforcement in 1999 if they had done the research.
42 And I just took a clip. There's so much
43 information here that's pertinent. "Those who die
44 after Taser use may have done so because of
45 indirect cardiac effects involving acidosis."
46 Okay? And it talks about the delayed deaths.
47 Look at the figure 15. If you go all the way to

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1 the right on the bottom, 45 RMS, 45 milliamps. So
2 the 7-Watt systems only put out 45 milliamps. So
3 they were well below the threshold of VF at 75 to
4 100 milliamps.

5 So what happened? Well, in '99, Sergeant
6 Darren Laur from the VPD, Victoria Police
7 Department, wrote a report in September '99, and
8 the purpose was to assist Canadian agencies with
9 the unbiased and truthful look at what's presently
10 available. Okay? His first comment in the
11 medical section was to say, "That Taser technology
12 is over studied is an understatement." I have an
13 issue with that statement. And that document was
14 used by the AG to approve these devices. He also
15 said, "The low power 5-Watt system is proven to be
16 medically safe." I would have challenged that.

17 This is the big one. This is published and
18 in his report, both his independent review and
19 also the piece that he had published by the CPRC:
20 "Underwriters Lab and International Electro-
21 Technical Commission have published that higher
22 power 26-Watt system is within ventricular
23 fibrillation limits." If you can just remember
24 that.

25 And then he said at the time, in '99, "More
26 studies are required on the new higher power
27 system." Okay? At the same time, in early 2000,
28 TASER International put out a document to law
29 enforcement explaining that they used an FDA
30 approach to developing this technology. Safe and
31 no side effects. This is very important because
32 this goes back to Laur's comment, underlined:
33 "Both UL levels and IEC levels...Underwriters Lab
34 and International Electro-Technical Commission
35 levels were used for this validation, as shown
36 on...page 9, the Advanced Taser is well within
37 internationally accepted electrical safety
38 standards."

39 So same document, Your Honour, page 9.
40 There's the graph. And he lists the IEC 479
41 threshold, and what's cut off is the UL standard.
42 And those are the two markings, the dotted line
43 and the one to the upper right. And you'll notice
44 where the Advanced Taser is in red. That location
45 is 162 milliamps. What was the threshold for VF?
46 75 to 100 milliamps.

47 There's another thing on this chart. This is

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1 a chart that TASER presented not once but twice in
2 their material. Here's the second time that they
3 published this again the next month, in February
4 2000, in a presentation Rick Smith gave to
5 National Defense Institute Association, and you'll
6 see where the old stun systems and the new ones
7 is. Again, it's 162 milliamps.

8 I want you to notice the axes. The vertical
9 axis is the body current. The horizontal axis is
10 the pulse width. This is the IEC 479 that he was
11 referring to, and the IEC 479 is the effects of
12 current on human beings and livestock. Now, I
13 don't have a pointer with me but -- thank you very
14 much. If you'll look, body current's down here on
15 the IEC 479. It's down there. Duration is up
16 here. Look at the thresholds for safety, the
17 direction it's going. Now I'll go back to the
18 graph they did. And whether it was intentional or
19 accidental, I don't know. But I do know these
20 axes were changed, but the direction of the
21 thresholds were not. And what this shows is that
22 it's well below the thresholds of VF, as they
23 stated. When you plot 162 milliamps, it's right
24 up in here. And if you look at the notes for what
25 that is, AC-4 -- okay, here it is. Increasing
26 with magnitude and time, you end up with VF and
27 cardiac arrest.

28 Now, just so no one thinks that I'm out to
29 get them and any other competitor in this
30 industry - because I'm not. I've learned from all
31 of them - this is a document that was from the
32 HECOE report, the Human Effects Center of
33 Excellence from the U.S. Air Force, which Pat
34 Reilly, who was here on Monday, actually was
35 involved in and sat in on all the boards. And
36 this says: "Comparisons of the M26 and X26 Taser
37 output to these published VF thresholds" - he's
38 talking about the IEC and Underwriters Lab - "have
39 been conducted by others." Comparisons have been
40 conducted by others. "However, these comparisons
41 are not appropriate since the underlying dose
42 metric used in the development of these standards
43 is not directly comparable to the Taser waveform,
44 and such comparisons are outside of the intended
45 use of the published standards." Okay? That IEC
46 standard is used for every single electrical
47 device in the world that's manufactured.

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1 Aside from -- this is the only one that isn't
2 referenced, and I have this document. It's from
3 their website. But the claim is made that "Aside
4 from minor irritation and burning where the arc
5 contacts the skin, or extended application which
6 could interfere with breathing, there are no
7 electrical safety issues associated with pulse
8 wave devices." That was about 2002, I believe.
9 But I can get you that reference, Your Honour.

10 "Except minor irritation or burning..."
11 Okay? This is a photo and it shows second degree
12 burns over the left breast and this is a direct
13 result of a Taser discharge at close range.

14 Another document -- and actually this is the
15 same one that shows the graph. Rick Smith says,
16 and he signed that letter: "Significant pre-
17 release medical testing involving both animal and
18 human testing has provided strong and
19 substantiable evidence that the new EMD technology
20 leaves no lasting injury and that the risk of
21 fatality is extremely small." Okay? Significant
22 pre-release -- and I e-mailed him and asked him
23 about this back in 2003-2004 because I wanted to
24 see the tests that he had done, and never got an
25 answer back. But if you go back to that one
26 website that I've listed, there aren't any studies
27 up there that indicate this.

28 Just another page from their website early in
29 2000: "The energy stored in the Taser is dumped
30 into" -- this is significant. Okay? Medical. VF
31 and acidosis. We covered VF already. Here's the
32 acidosis: "The energy stored in the Taser is
33 dumped into the attacker's muscles at a pulse
34 frequency rate that tells the muscles to contract
35 rapidly. The rapid work cycle instantly depletes
36 the attacker's blood sugar level by converting it
37 into lactic acid." And that creates lactic acid
38 and acidosis. "Unable to produce energy for his
39 muscles, his body becomes unable to function."

40 This is another one where the claim is that
41 it won't kill. And I have to say I wouldn't make
42 that claim. I wouldn't make that claim on our
43 system, and we're less powerful.

44 The graph below -- this is another one,
45 another where he's citing the same graph that they
46 used on the website. And I thought this was
47 interesting because on Tuesday morning Mike

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presenter)
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1 Messine made the comment, never ever ever never
2 ever have we said Tasers are compared to lethal
3 devices. Well, hmm -- Taser did. The technology
4 "compares quite favourably to the data in the same
5 study concerning the .38 Special handgun." They
6 compared it directly to a lethal weapon. And
7 again, while all the field studies to date have
8 been conducted -- and this is in 2002. So the
9 question is: What studies were done on the 26
10 before they were deployed? And the reason I bring
11 this up, Your Honour, is because I believe that
12 there was flawed methodology in how the technology
13 was brought to market in the late '90s and early
14 2000s.

15 This is a slide from an Army presentation in
16 2002, and it shows that the military bought into
17 the -- recognized the fact that these devices
18 cause lactic acid.

19 This, Your Honour, is a pretty interesting
20 document. This is what's called a HERB. It's a
21 Human Effects Review Board report, and these are a
22 couple of comments: "...the Board is concerned by
23 the clear lack of unbiased, peer-reviewed
24 scientific evidence of Taser effects and
25 effectiveness..." Next: "...investigate
26 Taser" -- they suggest investigating "...Taser
27 effects in a thorough, peer-reviewed unbiased risk
28 characterization of the device. This will address
29 the inadequate scientific evidence of the risks
30 posed..." That's 2002. "...it must be emphasized
31 that there is little, if any, peer-reviewed
32 scientific evidence that corroborates these vendor
33 provided findings." "In fact, no mechanism of
34 action for the Taser effect is clearly
35 understood." "Development of the Taser appears to
36 be based on serendipitous findings and trial and
37 error, as opposed to well-defined scientific
38 investigation."

39 And finally: "...electrical shock induced by
40 the Taser may result in acidosis... They
41 hypothesize this condition may" -- and he's
42 talking about the Sticky Shocker study from '99.
43 "They hypothesize this condition may precipitate
44 or contribute to cardiac arrest or fatal
45 arrhythmias particularly in subjects taking
46 drugs..." The reason the low-power system went to
47 a high-power system was because law enforcement

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1 wasn't getting the proper effect on individuals on
2 PCP or cocaine. Well, the problem is, one of the
3 first systems in the body, when you go on an
4 alternative substance like that, is your sensory
5 nerves are shot. They don't feel. So the subject
6 doesn't feel anything himself but his body
7 chemistry, blood chemistry, is changing. And the
8 officer's going, "This thing isn't working. I
9 need to stand on this thing. I just need to pull
10 it again." And then you end up with unintended
11 consequences.

12 Again, this is from the HERC. Now, the HERC
13 was a document that was -- the report that was
14 done after the HERB. The HERB suggested that a
15 HERC be done. And this is real interesting. This
16 is from the summary: "Several data gaps were
17 identified in the data evaluation. These gaps
18 include the biological basis of Taser effects,
19 appropriate dosimetry" -- what's dosimetry? You
20 hear a lot of times people going, "Hey, these
21 things are safer than Tylenol." Okay. But at
22 least Tylenol gives you a prescription and a dose.
23 They tell you how much and how many over how long.
24 Okay? That's what it's saying. "...appropriate
25 dosimetry, and the impact of environmental- and
26 scenario-dependent variables on the induction of
27 effects."

28 "Available lab data are too limited to
29 adequately quantify all possible risks of VF or
30 seizures..." This is in 2005. But law
31 enforcement was told in '99 that it was safe by
32 Sergeant Laur and by the manufacturer.
33 "Limitations in the exposure and incidence data
34 for some infrequent events, and the need to rely
35 on a database of case reports compiled by
36 manufactures..." That's what they recognize, was
37 there was limitations. This was really a
38 literature review. And I know that because I
39 corresponded with the HECO and there was not one
40 scientific study that they did for that report.

41 And Your Honour, all I wanted to do was
42 understand the system, so I asked. And this is
43 what I found out. Here is where you start.
44 Identify the effects of the device. And you know
45 what? They didn't know them all, but let's give
46 them the benefit of the doubt. Let's say you do.
47 Dose response data. Well, they just told us in

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1 the summary that it isn't there. So if it's not
2 there, where do you go? Threshold. Well, they
3 just said that in the summary. It wasn't there.
4 So where do you have to go? Back to more
5 research. That's why I think these things were
6 deployed prematurely.

7 Dose response curves. There are no dose
8 response (sic). They said that. And this is
9 basically the commander's brief summarizing the
10 HECO report. And I'm not going to bore you guys
11 because I don't have a real great reading voice,
12 but you can see, develop a dose response -- how
13 many? How long? And that's really my issue with
14 these devices. If you're going to deploy these,
15 you have to put a limitation. If you don't know
16 what the dose response is, you have to limit it.
17 If you don't, that's how it's abused. And that's
18 what the public has issue with. That's what I
19 have issue with as a manufacturer.

20 Determine the effect of EMD on respiration.
21 Okay. So you've got a subject. He's already on
22 something or not. He's under the threat of going
23 to jail, so he's rocking. He's probably been in a
24 fight or knows he's going to be in a fight, so his
25 heart rate's elevated.

26 THE COMMISSIONER: We have all this, sir.

27 A Okay. Okay, Your Honour. I'm sorry. This is a
28 letter from the External Panel for the Independent
29 Peer Review, and Your Honour, I'd be surprised if
30 you had this. The panel, when they got done with
31 the HECO, even though the HECO was specifically
32 for, in the title, the M26 and the X26, they only
33 felt comfortable acknowledging a statement on the
34 M26, not the X26. And the reason for, 98 percent
35 of the data that was reviewed was on the M26, not
36 the X26.

37 This is a letter from the United States Army
38 in 2005. It's a memo that went out to the Army,
39 every command, saying you don't Taser in training
40 because of health effects.

41 Potomac Policy Institute, 2005, we co-hosted
42 that, my company co-hosted that, and I absolutely
43 objected to the final report. And here's why.
44 They couldn't define "appropriately," how many and
45 how long. They couldn't do it. It hasn't been
46 done because the research hasn't been done.

47 This is the IECP, very well respected.

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1 Here's the first line: "This executive brief is
2 an initial analysis...focusing not on the
3 technology...but on the management..." That's
4 trying to develop a policy from the top down. And
5 without the science, you can't do it with this
6 technology.

7 You've seen this before, Your Honour. The
8 only thing I want to point out in here is that,
9 again, Mike Messine on Tuesday said: We don't
10 compare these to lethal devices. Well, Dr. Butt
11 did. Dr. Butt, he said these are great to use
12 instead of a firearm, where the alternative could
13 well be a firearm. That was a medical panel that
14 Mike Messine had been talking about on Tuesday.
15 Here's the first sentence in that study after the
16 list of doctors: "The purpose of this panel was
17 not to draw conclusions about the safety of the
18 Taser or other CEDs" but to talk about issues
19 related, medical issues.

20 We are -- hmm. We are. There are new
21 studies, and it's not one individual sponsored
22 study. There are multiple groups finding VF in
23 animals. And I've heard the comment, "Well, why
24 do you do an extended 40-second charge?" And you
25 know why you do that? It isn't because that's how
26 you're going to use it in the field. It's because
27 when you do that, you're going to be able to
28 measure the contraindications in the body, in
29 other words what's the most sensitive part of the
30 body that's affected by the technology. What
31 changes fastest?

32 Okay. And electrical -- a lot of that was
33 covered in the medical just because of the VF, and
34 this is almost over. Again, the thresholds are
35 for currents between 75 and 100 milliamps, and so
36 the output of the device should be below that.

37 We need a standard for measuring these
38 devices, and here's why. There's a number of
39 devices out there and there's more coming. ETL
40 admitted that there's no widely accepted means of
41 measuring these. So that's one of the things that
42 we should do.

43 So how do you measure these? There's a whole
44 bunch of different ways, and the proper way is
45 RMS, and it's not RMS average. It's root-mean-
46 square. And the reason for that is the root-mean-
47 square is the formula by which you can turn an

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1 irregular, dampened sinusoidal AC waveform, which
2 is what these devices put out, and you can convert
3 it to a DC equivalent. And from the DC
4 equivalent, we know how it affects the body. It's
5 measured in milliamps. That's not how some
6 manufacturers are advertising their devices. This
7 is the old way, where they did it for the M26 and
8 the X26. Both of those are over the threshold for
9 VF. The new way they're measuring, if you go on
10 their website now, they're doing what's called an
11 average, which does not apply. Because it's the
12 peaks in these waveforms that are dangerous, not
13 the average.

14 Okay. Just another example of not listing
15 the body current, the electrical output.

16 So measurement devices. All I'm going to say
17 is it's a shame that a law enforcement agency will
18 get one of these in 1999 and still be using it in
19 2008 and never tested the electrical output. They
20 do it for radar guns. They do it for
21 defibrillators. Why wouldn't you do it for this,
22 especially if they're over the threshold for VF?

23 Operational concerns. Your Honour, the
24 medical and the electrical considerations, they
25 really do have an effect on the use of force
26 parameters.

27 Modify restraint procedures. Like Mike
28 talked about - and that was wonderful - there
29 needs to be periodic measurement.

30 Policy concerns. Placement on the force
31 continuum. Standardized reporting criteria we've
32 talked about. There needs to be a developed
33 medical examiner protocol, because I have an
34 issue -- I really do. When these devices are used
35 and there is a related death, the first thing that
36 should happen is that device should be sent to the
37 MEs or somewhere for an electrical output
38 verification to make sure it's within the
39 manufacturer's specs. That has not been done. To
40 my knowledge it's been done one time.

41 So conclusions. In 1999, Darren Laur said
42 that, "To say that Taser technology has been over
43 studied is an understatement." In 2005, Mark
44 Wroble said, "Understanding the human effects of
45 non-lethal technology is fundamental..." And Pat
46 Reilly on Monday said, "We don't have enough
47 information available..." to determine certain

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1 thresholds.

2 Military, law enforcement and researchers
3 need to come to a consensus on the definition of
4 appropriate use and how to get there. Military,
5 law enforcement and researchers, there needs to be
6 oversight on the development and technology of the
7 emergent technologies. And the military, law
8 enforcement and researchers need to come to a
9 consensus on the standard reporting procedures.

10 And Your Honour, I'm just going to humbly
11 submit that there's really three options as far as
12 the technology and recommendations. Nothing can
13 be done at all, a simple review and status quo and
14 things are great. Or we can elevate the
15 technology on the force continuum so that less
16 unintended consequences -- so it's not such a
17 casual use, and parameters are put on the use
18 until science can identify what those parameters
19 should be. Or there can be a suggested or
20 recommended call for a moratorium.

21 And that's it, Your Honour.

22 THE COMMISSIONER: Well, sir, thank you very much for
23 taking the trouble of doing that. Very much
24 appreciated.

25 A Yes, sir.

26

27 (PRESENTER EXCUSED)

28

29 THE COMMISSIONER: Now we're going to adjourn to the
30 Wosk Centre on Monday morning at ten o'clock.

31

32 (PROCEEDINGS ADJOURNED TO MONDAY, MAY 12, AT
33 10:00 A.M.)

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