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ASSEMBLYMAN REED GUSCIORA, STEPHANIE HARRIS, COALITION FOR PEACE ACTION, and NEW JERSEY PEACE ACTION, Plaintiffs/Appellants, v. CHRISTOPHER J. CHRISTIE, GOVERNOR OF THE STATE OF NEW JERSEY, (in his official capacity) and KIMBERLY GUADAGNO, SECRETARY OF STATE OF THE STATE OF NEW JERSEY (in her official capacity), Defendants/Respondents.	SUPERIOR COURT OF NEW JERSEY APPELLATE DIVISION DOCKET NO.: A-005608-10T3 On Appeal from: LAW DIVISION: MERCER COUNTY DOCKET NO.: MER-L-2691-04 Sat below: Linda R. Feinberg, A.J.S.C. CIVIL ACTION

BRIEF OF APPELLANTS

* Counsel for Appellants acknowledge the work of Rutgers Law School Students Julia Casteleiro, Isabel Chou, Mark Heinzelmann, Erin Phalon and Jorge Sanchez in helping to prepare this brief.

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PRELIMINARY STATEMENT

Every scientific study conducted of paperless voting machines (Direct Recording Electronic Voting Machines, or "DREs") has concluded that they are insecure and easy to manipulate, and that a hacker or virus can change the outcome of an election. This is also true of the Sequoia Advantage 9.00H DRE, which is used throughout the State of New Jersey multiple times each year by New Jersey voters. Appellants filed this lawsuit challenging the use of New Jersey's paperless DREs in October 2004. Seven years later, the voting machines of this State remain insecure and subject to attack. The trial court failed to decommission these DREs, despite overwhelming scientific evidence showing the many ways that they could be hacked. Appellants respectfully request that this Court reverse the trial court's findings, and uphold the New Jersey Constitution and Title 19 to protect the integrity of the franchise in this State.

In 2004, DREs were still relatively new in most of the country. Their use proliferated in the wake of the 2000 Presidential election, when it became clear that antiquated voting machines (that made it impossible for election officials to determine voter intent when tabulating votes) could affect the outcome of a Presidential election.

Florida's "hanging chads" made infamous during the 2000 Presidential election led to the enactment of HAVA, the Help America Vote Act, 42 U.S.C. §§ 15301-15545 (2009). HAVA provided tens of millions of dollars to states to modernize their voting systems. Indeed, since 2002, New Jersey has received between $80–$90 million in federal funds under HAVA. States throughout the country used their HAVA funds to purchase computerized voting systems, or DREs, believing that computerized voting technology would be more effective in tabulating votes.

Computer scientists, who are not normally associated with political advocacy, were the first to realize and speak out about the fatal flaw of computerized voting machines: they can be made to cheat. A computer will do what you tell it to do, and only what you tell it to do. You can program a computer to play chess, Jeopardy, or cheat during elections. With a little extra work, you can tell the computer to cover its tracks. In addition, a computer that is not programmed properly can declare the losers as victors, and the victors as losers. This is precisely what happened in Cumberland County, New Jersey in June 2011, after the Sequoia Advantage DRE misattributed votes and gave the election to what ultimately proved to be the losing candidates.

Computer scientists and other advocates, understanding that these issues could lead to serious disenfranchisement of the voting public, began a campaign to make voting machines verifiable. Scientists universally agree that the best way to verify votes cast on DREs is through a voter verified paper ballot ("VVPB," also known as a Voter Verified Paper Audit Trail or "VVPAT"). VVPBs can take a number of forms, such as an actual paper ballot, or a paper ballot that the voter fills out before it is scanned and counted by a voting computer, or a lottery-ticket-size mini-ballot that the computer generates and the voter reviews before casting his or her vote. In all cases, the paper ballots count as the official ballots in the event of a challenge to the election results, or a voting machine malfunction.

But VVPBs, in and of themselves, cannot detect fraud. To fully ensure that the voting computers are not cheating, it is necessary to audit a certain percentage of voting machines in each election precinct by manually counting the paper ballots and comparing the hand-counted results with the computer-generated results. Finally, to ensure that votes are counted accurately, it is imperative that totals be counted and announced at the precinct level. This protects against tampering with voting machines and paper ballots while they are being transported to centralized tabulation locations.

In theory New Jersey is among the states that require voting machines to produce a paper ballot. But New Jersey's commitment to verifiable elections remains just that – a theory.

Our legislative and executive branches have failed the people of New Jersey by failing to implement the VVPB law. Thus, it is up to the courts to protect the right to vote. Unfortunately the trial court here made numerous errors of law and fact and ultimately found that while the State's 11,000 Sequoia Advantage DREs were insecure, their continued use did not violate the New Jersey Constitution or Title 19. This Court can rectify this unsupportable legal conclusion and order that the State's 11,000 DREs be replaced with fully auditable voting machines. Only then will New Jersey be in the company of the majority of states; states that protect their citizens' most precious right – the right to vote.

PROCEDURAL HISTORY

Plaintiffs filed a Complaint in Lieu of Prerogative Writ dated October 19, 2004. (See generally Compl.; Pa1-45.) The State filed no responsive pleadings, and instead moved to dismiss.

This lawsuit, Gusciora v. McGreevey, No. MER-L-2691-04, slip op. at 30 (N.J. Super. Ct. Jan. 13, 2005), was originally dismissed by the trial court, and Plaintiffs appealed. (See Gusciora v. Christie, No. MER-L-2691-04 (Law Div. Feb. 1, 2010)

(slip op. at 5); Pa146.) In 2005, the legislature passed L. 2005, c. 137 (codified at N.J.S.A. 19:48-1b, N.J.S.A. 19:53A-3, and N.J.S.A. 19:53A-3.1), which required all voting machines to produce a VVPB by January 1, 2008 and that the VVPB be used in the event of a recount.

This Court heard the appeal of the dismissal in 2006. It denied the State's motion to dismiss the appeal as moot, and retained jurisdiction over the case. (See Gusciora, slip op. at 6 (Law Div. Feb. 1, 2010); Pa147.) At that time, the Appellate Division ordered an emergency trial on two issues: (1) whether technology existed for the State to satisfy the voter verified paper ballot requirement; and (2) under what circumstances, if any, would the State argue that it was exempt from complying with N.J.S.A. 19:48-1b and N.J.S.A. 19:53A-3. (Id. at 7-8; Pa148-49.) At the conclusion of that emergency trial, the trial court found that although technology existed in the marketplace that satisfied the statutory requirements, the technology was not compatible with New Jersey's DREs. No technology existed to retrofit New Jersey's 11,000 Sequoia Advantage DREs with a printer that would produce a VVPB. If New Jersey continued to use its current voting machines, it could not meet the January 1, 2008 statutory deadline. (See Gusciora, slip op. at 6-7 (Law Div. Feb. 1, 2010); Pa147-48.)

After the emergency trial, the Appellate Division heard oral argument for a second time and issued an opinion. Gusciora v. McGreevey, 395 N.J. Super. 422, 423 (App. Div. 2006). The Appellate Division reinstated the case and remanded it for monitoring by the trial court, with a mandate that the trial court hold a trial on the merits if the State failed to meet the N.J.S.A. 19:48-1b voter verified paper ballot deadline. Id. at 427.

The trial court held monthly status conferences for over two years, from 2006 to 2009, to monitor the State's compliance with the Title 19's voter verified paper ballot requirement. During that time, instead of meeting the statutory deadline, the Defendants petitioned the legislature to extend the statute's deadline. The legislature extended the VVPB deadline three times, and finally left it open indefinitely until funds became available. See L. 2007, c. 301; L. 2008, c. 18; L. 2009, c. 17.

Notably, the legislature did not suspend or in any way invalidate the voter verified paper ballot requirement. Instead, it strengthened it. In 2008 the legislature passed N.J.S.A. § 19:61-9 which requires that after every election, an "independent, professional audit team" recount, by hand, a statistically valid sample of paper ballots. This law, along

with the voter verified paper ballot requirement would be able to reveal whether any DRE cheated in an election.

Because the Defendants failed to meet statutory deadlines, beginning in January 2009, a multi-month trial was held on the merits. Consistent with the trial court's briefing schedule, counsel for the Plaintiffs filed recommended findings of fact and conclusions of law on July 5, 2009. (Gusciora, Slip op. at 12 (Law Div. Feb. 1, 2010); Pa153.) The State filed recommended findings of fact and conclusions of law on September 21, 2009. (Id.) With the trial court's consent, Appellants filed a rebuttal brief on November 20, 2009. (Id. at 12-13; Pa153-54.)

The trial court issued an opinion on February 1, 2010, (id. at 1; Pa142), and subsequently issued an order on March 8, 2010, which recognized that New Jersey's voting machines are not secure. (March 8, 2010 order at 1; Pa135.) The trial court ordered the State to take the following measures to secure New Jersey's DREs: (1) the Title 19 Voting Machine Committee shall be reconstituted to include two "mechanic experts" who have an understanding of computer systems and software and hardware architecture; (2) within 120 days of the trial court's Opinion, the reconstituted Title 19 Committee shall conduct a full certification examination of the Sequoia AVC Advantage DRE system as currently configured and prepare a report, whereupon the Secretary of State shall have 60 days from the receipt of

the report to render a final decision; (3) both hardening and anti-virus software applications shall be installed on all computer systems in the State that are used for election management purposes within 120 days of the trial court's Opinion; (4) the State shall develop a seal-use protocol for the tamper-evident seals on the State's voting machine and submit it to the trial court within 120 days of the trial court's Order, and such protocol shall include a training curriculum and standardized procedures for the recording of seal serial numbers and maintenance of appropriate serial number records; (5) the State shall within 60 days of the trial court's Order advise the County Clerks that computers utilized for election-related duties shall at no time be connected to the Internet; (6) that each County Clerk shall conduct an examination of the means in which election data is transmitted to his or her office after an election, and once this information is collected, the State shall assist the counties in developing action plans to ensure the integrity of the transmittal of voting data between the municipal clerks' offices and the County Clerk. In the event a county does not provide a plan, results cartridges in that county shall be personally delivered to the County Clerk for tabulation. (Id. at 2-4; Pa136-39.) The trial court's order also provided recommendations to further secure the voting machines. (Id. at 4-5; Pa138-39.)

The State failed to meet the trial court's 120-day deadline for compliance with the order in every respect. (9/23 Hr'g Tr. at 27:20-25.)

Instead of issuing a contempt order, or even a final order as Plaintiffs requested, the trial court retained jurisdiction over the case for nearly a year-and-a-half after she issued her March 8, 2010 order. Over the course of that time, the case remained active. The trial court heard a number of motions to enforce litigant's rights filed and argued by the Plaintiffs. She also issued a series of findings, many of which are contested in this Appeal.

The trial court entered a final order and judgment on June 6, 2011. (Final Order and Judgment; Pa140-41.) Plaintiffs' appeal followed. (Notice of Appeal at 1-12; Pa348-59.)

STATEMENT OF THE FACTS

I. BACKGROUND

The Sequoia AVC Advantage 9.00H is a Direct Recording Electronic ("DRE") voting machine. (See Appel Test., 1/27 Trial Tr. at 106:20-25; Appel Report, § 2.1, at 9; Ex. P-2; Pa541.) At the time of the trial, approximately 11,000 of these DREs were in use in New Jersey, in 19 out of 21 counties. A DRE is a computer with a user interface, such as a touch screen or a panel, which stores votes during an election and can communicate election results at the end of the day. (Appel Test., 1/27 Trial Tr. at 104:24 to 105:17.)

The Sequoia AVC Advantage 9.00H lacks any voter verified paper ballot or independent audit trail or other way to verify that its findings are accurate. (Appel Test., 2/5 Trial Tr. at 55:19-24; Appel Report, § 2.4, at 11; Ex. P-2; Pa543.) The only record of the election is the vote totals the DRE itself provides at the end of the day. (Id.) Therefore, it is a "black box" with no verifiable accuracy. (Id.) As such, like all other computers, the Sequoia AVC Advantage 9.00H DRE can be programmed to do whatever the programmer tells it to do, and is inherently insecure and unreliable. (Appel Test., 2/5 Trial Tr. at 54:5 to 56:4; Appel Report, § 2.4, at 11; Ex. P-2; Pa543.)

The voter interface of the Sequoia DREs at issue in this case is a panel on the front of the DRE with numerous rows of

buttons programmed to correspond to different candidates or to different answers on ballot questions, covered with a mylar sheet to indicate to the voter which buttons correspond to which candidates or ballot questions. (See Appel Test., 1/27 Trial Tr. at 156:4-8, 162:23 to 163:4, 173:14 to 174:6; Appel Report, §§ 2.1-2.2, at 9-11; Ex. P-2; Pa541-43.) The voter interface provides a false sense of security because, unless the firmware in the DRE is programmed properly, there is no necessary correlation between pressing a button next to a candidate's name and the DRE actually registering a vote for that candidate. (Appel Test., 1/28 Trial Tr. at 97:2-6; Appel Report, § 2.3, at 11; Ex. P-2; Pa543.)

After several DREs failed to register votes during the "Super Tuesday" 2008 Presidential Primary Election, pursuant to court order, Professor Andrew Appel, Chair of Princeton University's Computer Science Department, and a team of top computer scientists examined two Sequoia AVC Advantage 9.00H DREs provided by Appellees. (Appel Report, § 1.3, at 7; Ex. P-2; Pa538; Appel Test., 1/27 Trial Tr. at 118:20-24.) Professor Appel and his team spent an extraordinary number of person-hours inspecting and experimenting on the Sequoia AVC Advantage 9.00 DREs. His team spent almost seven days a week during the month of July 2008 examining the DREs, working between six to ten hours a day. (Appel Test., 1/27 Trial Tr. at 142:8 to 143:2.)

Pursuant to court order, the examination took place at a remote location 30 minutes away from Princeton. (Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. May 20, 2008) (Protective Order, ¶ 11, at 7; Pa367.)) The scientists could not bring their cell phones into the examination room, and had no Internet access. (Id.)

Even under these difficult examination constraints, the time window for examining the DREs was limited by the trial court to thirty days. Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. June 20, 2008) (Modified Protective Order, at 1; Pa376.) The Appellees further erected numerous obstacles to Appellants' examination, depriving Professor Appel and his team of the opportunity to perform some tests and procedures they would otherwise have conducted. Despite repeated promises to replace defective daughterboards after they ceased functioning, Appellees never did so, depriving Appellants of an opportunity to demonstrate numerous flaws in these components. (Exs. P-22A, P-22B, P-22C, P-22D, P-22E; Pa753-62.)

Further, despite having had months of time to prepare for the court-ordered examination of the Sequoia DREs, on June 30, 2008, Sequoia produced a grossly incomplete subset of the source code. Sequoia failed to include the source code for numerous third-party library files, lacked build tools such as a compiler, and completely lacked any source code, firmware, or

configuration files for the operating system on the daughterboard. (Appel Report, § 54.5-7 at 112-13; Ex. P-2; Pa643-44.)

If given the time, Professor Appel would have fabricated a fraudulent Z80 chip. (Appel Test., 1/28 Trial Tr. at 143:17-24.) This project would have taken Professor Appel at least a month, and possibly as long as three months. (Appel Test., 1/29 Trial Tr. at 28:2-5.)

Despite these difficulties, Professor Appel and his team were able to examine the Sequoia Advantage 9.00H DREs long enough to conduct significant experimentation and to reach conclusions about the reliability, accuracy, and security of the Sequoia Advantage 9.00H. (Appel Test., 1/27 Trial Tr. at 143:3-6.) Following the examination of the Sequoia 9.00H DREs, Professor Appel wrote a lengthy and detailed Expert Report containing narrative descriptions of all of the different insecurities and inaccuracies in the AVC Advantage DREs that he was able to uncover during the thirty-day examination. (Appel Test., 1/27 Trial Tr. at 143:18-23.)

The Expert Report is not an exhaustive encyclopedia of all flaws and insecurities in the Sequoia Advantage DRE. (Appel Test., 2/5 Trial Tr. at 11:11 to 12:8.) It discusses only flaws which could be uncovered and fully analyzed in a thirty-day period, parts of which were spent trying to obtain materials

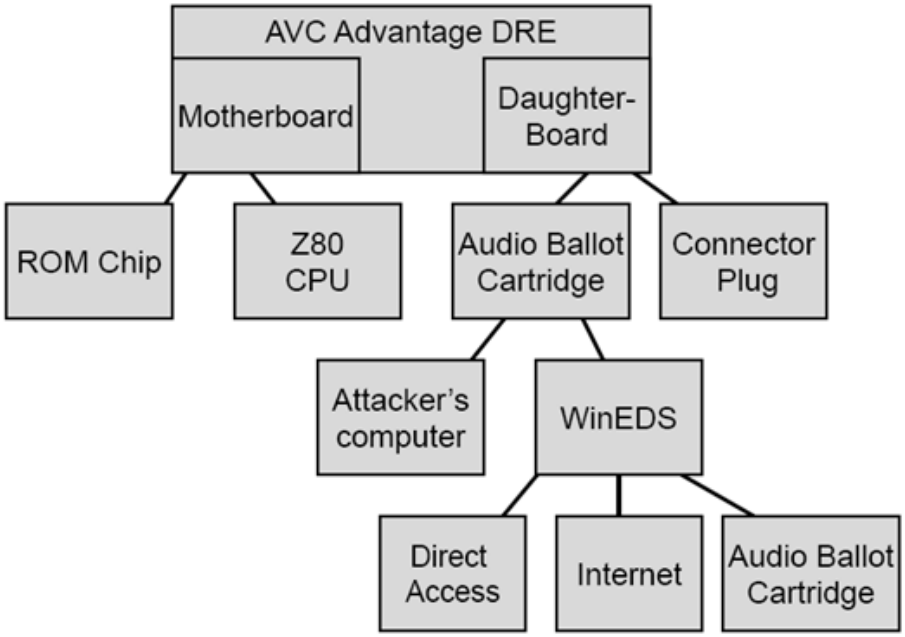
from Sequoia. (Id.) The flaws Professor Appel uncovered, however, provide sufficient basis for his sound conclusions that the Sequoia Advantage 9.00H is unreliable, inaccurate, and insecure. (Appel Test., 2/5 Trial Tr. at 11:11 to 12:8; Appel Report, § 68, at 143-44; Ex. P-2; Pa674-75.) Professor Appel's Expert Report was admitted into evidence as Exhibit P-2 and appears in the Appendix to Appellant's brief as Pa532.

Professor Appel and his team examined a number of aspects of the Sequoia AVC Advantage 9.00H DREs, including but not limited to source code, the operation of the DREs, and how the tabulation system, the WinEDS database computers, interact with the DREs. (Appel Test., 1/27 Trial Tr. at 144:5-15.)

On August 20 and 21, 2009, Professor Appel created a videotape demonstrating inaccuracies and insecurities of the Sequoia DREs. (Appel Test., 1/27 Trial Tr. at 147:22 to 148:3.) The videotape was transferred to four DVDs that were included in Professor Appel's Expert Report. (Exs. P-3, P-4, P-5, P-6; Pa728-31.)

After thirty days of studying the Sequoia Advantage 9.00H DRE and its accompanying WinEDS system, Professor Appel found that the AVC Advantage could be attacked in all of the ways demonstrated by the chart below:

PATHWAYS TO INSERT FRAUDULENT FIRMWARE INTO THE AVC ADVANTAGE



(Ex. P-15; Pa740-42.)

As will be discussed in greater detail herein, the results of the attacks to the Sequoia Advantage 9.00H DRE and its tabulation system, the WinEDS system, can be a complete, undetected stealing of votes. It can also be a complete disabling of targeted DREs.

The Appellees did not put on any witnesses to testify that the Sequoia AVC Advantage DREs are secure and reliable. The trial court precluded the Appellees' expert witness, Dr. Shamos, from presenting an opinion as to the security or reliability of any part of any DREs used in New Jersey because he never performed any scientific study of New Jersey's DREs. (Collaquy,

1/27 Trial Tr. at 38:4-6.) Thus, Professor Appel's testimony on these matters was not contested by the Appellees.

Appellants' second expert witness, Professor Wayne Wolf, Rhesa "Ray" S. Farmer, Jr., Distinguished Chair of Embedded Computing Systems and Georgia Research Alliance Eminent Scholar at the Georgia Institute of Technology (Georgia Tech), prepared an expert report discussing how New Jersey's DREs can be hacked by replacing the Z80 chip, or "brains" of the DREs. (Ex. P-117 at 2-4; Pa1191-93) Professor Wolf's expert report was admitted into evidence as Exhibit P-117 and is included in the Appendix to Appellants' brief at Pa1190.

Appellants' third expert witness, Dr. Roger Johnston of Argonne National Laboratories, who has one of the highest "top secret" security clearances in the country, and assesses threats to the United States' national security, devised a hack of the Sequoia Advantage DRE through its front panel. (Ex. P-81 at 1-2, 31-34; Pa1068-69; Pa1098-101.) By doing so, he concluded that elections can be manipulated without accessing any computer chip or microprocessor. (Ex. P-81 at 31-34; Pa1098-101.) Any voter can execute this frontal hack. (Id.) Dr. Johnston discussed his hack in full in his expert report, which was

admitted into evidence as P-81 and appears in the Appendix to Appellants' brief at Pa1068.[1]

II. APPELLANTS HAVE PROVEN THAT THE SEQUOIA ADVANTAGE 9.00H AND ITS WinEDS TABULATION SYSTEM CAN BE HACKED EASILY.

A. There Is Overwhelming And Uncontested Evidence Showing That The Sequoia AVC Advantage 9.00H Is Unreliable.

1. The Sequoia Advantage 9.00H Is Unreliable Because A Legitimate ROM Chip On The Motherboard Can Be Easily Replaced With A Fraudulent ROM Chip That Makes The DRE Cheat.

The firmware that controls the Sequoia AVC Advantage 9.00H resides on four ROM chips on the motherboard. (Appel Test., 1/28 Trial Tr. at 54:17-24.) Firmware is a computer program, like software, but more or less permanent. (Appel Report, § 3.2, at 15; Ex. P-2; Pa547.) In contrast, ROM stands for "Read-Only Memory," and its contents are permanent. (Appel Test., 1/28 Trial Tr. at 87:3-5.) Prof. Appel wrote a fraudulent, vote-stealing version of the Sequoia firmware by changing 122 lines of program source code out of approximately 130,000. (Appel Test., 1/28 Trial Tr. at 85:20-25; Ex. P-16.) Then, he wrote the changed part of the firmware to a single ROM chip, using an inexpensive, readily available device called a ROM reader/programmer. (Appel Test., 1/28 Trial Tr. at 85:20-25; Ex. P-16; Pa743.)

[1] A DVD of the frontal hack appears in Pa1775.

This entire process took two weeks; and writing the fraudulent firmware to a ROM chip took about ten seconds. (Appel Test., 1/28 Trial Tr. at 85:20-25.) Appellants' expert witness, Dr. Shamos agrees that the process of writing a ROM chip takes mere seconds. (Shamos Test., 3/24 Trial Tr. at 119:24 to 120:1.) Once the firmware is written, more fraudulent ROM chips can be rapidly generated in mass quantities to make as many Sequoia Advantage DREs as wanted cheat.[2] (See Shamos Test., 3/24 Trial Tr. at 119:24 to 120:1.)

Prof. Appel demonstrated the process of replacing a legitimate ROM chip on the motherboard[3] of the Sequoia AVC Advantage 9.00H DRE with a vote-stealing ROM chip. The process took him under seven minutes on videotape. (Appel Test., 1/28 Trial Tr. at 82:5-9; Appel Report, § 4.2, at 16; Ex. P-2; Pa548.) This simple process would pose no difficulties to anyone

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[2] There are now EPROM chips, Erasable Programmable Read-Only Memory (P-13). However, the general principle is that it requires slightly more effort to rewrite Read-Only Memory than normal memory. (Appel Test., 1/28 Trial Tr. at 87:8-13; Ex. P-16.)

[3] The motherboard "is the primary printed circuit board in a computer or other electronic device." PCMAG.com, Definition of: motherboard, http://www.pcmag.com/encyclopedia_term/0,2542,t=motherboard&i=47252,00.asp#fbid=7ttyrn1bXBp (last visited Oct. 11, 2011). "In a modern desktop computer, the motherboard contains the CPU and memory sockets as well as the chipset, which houses the control circuits for all the peripheral devices." Id. The motherboard may have slots for additional peripherals. Id.

capable of using a screwdriver. Several ROM chips are in evidence. (EPROM chip, P-13; fraudulent ROM, P-18) (EPROM chip; Ex. P-13; Pa738; fraudulent ROM; Ex.P-18; Pa745.)

Prof. Appel's physical demonstration consisted simply of picking the lock on the back of the DRE, unscrewing 10 screws on the circuit board cover, popping one of the four legitimate ROM chips out of its socket on the motherboard and replacing it with a ROM containing fraudulent firmware. (DVD 4 Tape 4, at 4:28 to 11:22; Ex. P-6; Pa731.) After Prof. Appel's demonstrations of the ROM hack, both on video and before the trial court, the Advantage 9.00H DRE was permanently altered, and would cheat in every subsequent election. (Appel Test., 1/28 Trial Tr. at 108:6-21; DVD 4 Tape 5 at 123:13 to 14:12, Exs. P-20, P-21; Pa747-52; Ex. P-6; Pa731.) Dr. Shamos agrees that fraudulent firmware could be designed to cheat in subsequent elections. (Shamos Test., 3/25 Trial Tr. at 7:8-14.)

To demonstrate his vote-stealing program, Prof. Appel ran two full elections. (DVD 3 Tape 3, at 7:50 to 20:50; Ex. P-5; Pa730.) To demonstrate how the DRE functioned before it was hacked, Prof. Appel first conducted an election as it would be run on a normal election day. (DVD 3 Tape 3, at 28:10 (Zero Tape), 37:10 (Results Report); Ex. P-5; Pa730.) The ballot for Prof. Appel's election was the exact ballot used in the 2008 Democratic Presidential primary. (Appel Test., 1/27 Trial Tr. at

165:20 to 166:5; Appel Report, § 4.8, at 17; Ex. P-2; Pa549.) That ballot was already loaded into the DRE that the State produced for Prof. Appel's team. (Appel Test., 2/5 Sealed Trial Tr. at 19:19-20.)

The test was simple. Every voter was a Democratic voter, and the voters cast 16 votes for Bill Richardson and 4 votes for Dennis Kucinich. (DVD 3 Tape 3, at 28:10 (Zero Tape), 37:10 (Results Report); Ex. P-5; Pa730.) First, Prof. Appel ran a "test" election in Pre-Election Logic and Accuracy Testing, or pre-LAT mode, which is a diagnostic test. (DVD 3 Tape 3, at 7:50 to 20:50; Ex. P-5; Pa730.) When Pre-LAT mode was finished, Prof. Appel turned off the DRE. (Id.) He then turned the DRE back on, and the DRE was in real election mode, where votes were tabulated and stored as official election records. (DVD 3 Tape 3, at 37:10; Ex. P-5; Pa730.) The DRE properly reported the election results in the test election: 16 votes for Bill Richardson and 4 votes for Dennis Kucinich. (Id.; Ex. P-19 is a handwritten tally of votes cast in the Pre-LAT test; and Ex. P-20; Pa746 is the Pre-LAT report printed by the DRE; Pa749.)

Then, in under seven minutes, Prof. Appel replaced the legitimate ROM chip with the ROM chip containing the fraudulent firmware that he designed. (DVD 4 Tape 4, at 4:28 to 11:22; Ex. P-6; Pa731.) Dr. Shamos admits that it is possible for unauthorized personnel to replace the ROM chip in the AVC

Advantage 9.00H DRE with a fraudulent ROM chip which steals votes, and that this would render the AVC Advantage inaccurate. (Shamos Test., 3/23 Trial Tr. at 112:4-6.)

Prof. Appel designed the fraudulent firmware on the ROM chip he created to act normally in Pre-LAT mode (to avoid detection), and only to cheat when the DRE was in election mode. (Appel Test., 1/28 Trial Tr. at 92:19-21; Appel Report, § 4.2, at 16; Ex. P-2; Pa548.) Prof. Appel designed the fraudulent firmware to wait until 20 votes have been cast, and then to switch half the votes for the candidate assigned to the HI 3 button (Bill Richardson) to the candidate assigned to the El 3 button (Dennis Kucinich). (Appel Test., 1/28 Trial Tr. at 94:25 to 95:5.)

Prof. Appel conducted a second full election, identical to the first in all respects, using his fraudulent firmware. (Appel Test., 1/28 Trial Tr. at 103:13-22; DVD 4 Tape 4, at 25:34 to 34:58; is Ex. P-6; Pa731.) The firmware, as planned, acted normally during Pre-LAT testing, reporting 16 votes for Bill Richardson and 4 votes for Dennis Kucinich. (Appel Test., 1/28 Trial Tr. at 103:13 to 104:1; Ex. P-20; Pa747). As designed, the fraudulent firmware was activated when the DRE was in official election mode, transferring half of Bill Richardson’s votes to Dennis Kucinich. (Appel Test., 1/28 Trial Tr. at 108:6-21.) Although voters had cast 16 votes for Bill Richardson, and had cast 4 votes for Dennis Kucinich, Prof. Appel’s fraudulent

firmware stole 8 of Bill Richardson's 16 votes and gave them to Dennis Kucinich. (Appel Test., 1/28 Trial Tr. at 108:17-21.) When the fraudulent firmware added those 8 stolen votes to Dennis Kucinich's 4 actual votes, Kucinich finished with 12 votes. (Id.) The final result was 12-8 for Kucinich. Prof. Appel's fraudulent firmware enabled Dennis Kucinich to win an election he had actually lost to Bill Richardson by 16-4. (Appel Test., 1/28 Trial Tr. at 108:12-21; Exs. P-19, P-20; Pa746-49.)

Prof. Appel was able to hack the Sequoia Advantage 9.00H using only common computer science skills, a ROM reader/programmer which cost $149, a ROM chip which retails for $3.87, and a set of lockpicking tools which cost $40. (Appel Test., 1/28 Trial Tr. at 87:3-5; 87;8-13; 79;2-5; Exs. P-13, P-16, P-17, P-18; Pa738; Pa743-745.) Prof. Appel could have performed his hack using a much cheaper set of tools. (Appel Test., 1/28 Trial Tr. at 80:2-5.)

2. The Sequoia Advantage 9.00H Is Unreliable Because Anyone With Moderate Computer Skills Can Devise Many Other Ways To Make It Steal Votes.

For purposes of demonstrating the hack in a reasonable amount of time to the trial court, Prof. Appel made it wait until the 20th vote was cast. (Appel Test., 1/28 Trial Tr. at 93:6 to 94:21; Appel Report, § 4.3, at 16; Ex. P-2; Pa548.) However, it

is no more difficult to make fraudulent firmware wait to cheat until after 200 or 500 votes are cast, or to choose any other arbitrary number of votes to wait before cheating. (Appel Test., 1/28 Trial Tr. at 94:4-21.)

Prof. Appel also testified that there are many other computer programs he could devise to steal votes. (See Appel Test., 1/28 Trial Tr. at 126:13-23; Appel Report, § 7.1, at 26; Ex. P-2; Pa558.) Some examples include:

- Stealing votes as they are cast, reporting to voters that their votes were counted correctly, while actually counting them for another candidate. (Appel Test., 1/28 Trial Tr. at 110:16 to 111:2; Appel Report, § 3.3(1), at 15; Ex. P-2; Pa547.)

- Instead of waiting for a certain number of votes, fraudulent firmware could wait until just before the polls close to steal votes. (Appel Test., 1/28 Trial Tr. at 94:4-21.)

- Fraudulent firmware could check what precinct it is in and only cheat if it is in a precinct where the attacker wants to cheat. (Appel Test., 1/29 Trial Tr. at 74:17-23; Appel Report, § 24.2, at 69; Ex. P-2; Pa600.)

- Fraudulent firmware could cheat based on whether a candidate's name appeared to be female or Hispanic, based on the party identification of candidates, or could base its cheating on any information available to it in the information stored in the DRE. (Appel Test, 1/28 Trial Tr. at 110:16 to 111:2.)

- Fraudulent firmware could also record votes in sequence, allowing corrupt poll workers to tell who voted for whom, violating ballot

> secrecy. (Appel Report, § 3.3(3), at 15; Ex. P-2; Pa547.)

These other proposed cheating techniques present no more difficulty than the hack he demonstrated before the trial court. (See Appel Test., 1/28 Trial Tr. at 126:13-23; Appel Report, § 7.1, at 26; Ex. P-2; Pa558.)

It does not take a programmer of Prof. Appel's skill level to program the simple computer inside the Advantage 9.00H DRE (Id.) Dr. Shamos agrees that a person with ordinary computer training could create a vote-stealing program for a Sequoia AVC Advantage DRE. (Shamos Test., 3/23 Trial Tr. at 136:7-12.) Dr. Shamos also agrees that it is possible to create fraudulent firmware that can evade detection. (Shamos Test., 3/23 Trial Tr. at 130:16-17.) Dr. Shamos additionally admits that there is no test used by New Jersey to determine that the firmware in an AVC Advantage is legitimate, nor is there any certified device to test ROM chips to see if the firmware on them is legitimate. (Shamos Test., 3/25 Trial Tr. at 21:15-25; Shamos Test., 3/23 Trial Tr. at 143:4-5, 142:22-24.)

Indeed, the Appellees' witnesses unanimously agree that hacking presents a threat to voting machine security in the State of New Jersey. (Smith Test., 3/19 Trial Tr. at 4:14-16; Terwilliger Test., 3/30 Trial Tr. at 159:1-4.) Mr. Smith testified that in his prior work for Hart Intercivic, another

voting machine manufacturer, that company's voting machines were attacked by technically skilled hackers on multiple occasions. (Smith Test., 3/19 Trial Tr. at 6:1-6.) To Mr. Smith's knowledge, none of these hackers were ever caught. (Smith Test., 3/19 Trial Tr. at 8:1-4.)

Mr. Terwilliger agrees that fraudulent firmware could avoid detection by Pre-LAT testing. (Terwilliger Test., 3/30 Trial Tr. at 167:21-24.) Mr. Smith admitted that Sequoia was aware of the fraudulent firmware problem and chose not to notify New Jersey officials about these weaknesses in the 9.00H DRE. (Smith Test., 3/18 Trial Tr. at 192:3-11.) Mr. Smith also admits that Pre-LAT testing is not a tool for detecting fraudulent firmware. (Smith Test., 3/18 Trial Tr. at 194:7 to 195:2.)

3. The Sequoia 9.00H Is Unreliable Because Hundreds Of Thousands Of Individuals Possess The Skills To Create Fraudulent Vote-Stealing Firmware In The Form Of A Fake Z80 Chip On The Motherboard.

Prof. Appel and Prof. Wayne Wolf (Appellants' other expert witness who is an Eminent Scholar and holds a Distinguished Chair at Georgia Tech University) both testified that it is a simple matter to design a processor chip which imitates a legitimate Z80 processor, but contains fraudulent firmware which steals votes much in the same way as Prof. Appel demonstrated with a ROM chip. (Appel Test., 1/29 Trial Tr. at 21:1 to 23:12; Wolf Test., 5/11 Trial Tr. at 27:18 to 28:6, 31:20 to 32:6; Wolf

Report ¶ 6; Ex. P-117; Pa1193.) The imitation Z80 processor would bypass the firmware on the program ROM, and instead run fraudulent vote-stealing firmware. (Appel Test., 1/29 Trial Tr. at 21:1 to 23:12.) Dr. Shamos agrees that it is possible to do this. (Shamos Test., 3/25 Trial Tr. at 143:11-16.)

Replacing the Z80 processor on the motherboard is almost as easy as replacing a ROM chip on the motherboard. (Appel Test., 1/29 Trial Tr. at 20:19-25.) The only added step is desoldering the Z80 chip from the motherboard and resoldering the fraudulent Z80 chip onto the motherboard. (Appel Test., 1/29 Trial Tr. at 24:8-20.) Anyone with a cheap, readily available desoldering tool, soldering iron, and minimal technical skills could easily perform this task. (Appel Test., 1/29 Trial Tr. at 24:8-20, 25:11-21; Appel Report, Fig. 18, at 46; Ex. P-2; Pa578.) A tool to remove solder can be purchased for $30 or less. (Appel Test., 1/29 Trial Tr. at 25:11-21.) The skill needed to desolder and solder a chip to a motherboard is very common in electrical engineering, and in the electronics repair field. (Appel Test., 1/29 Trial Tr. at 25:2-10.)

This hack would be more difficult to detect than the program ROM hack, because the program ROM chips would still contain the legitimate firmware. (Appel Test., 1/29 Trial Tr. at 27:9-11; 27:15 to 28:1.) Even if election workers upgraded the firmware by replacing fraudulent or legitimate program ROMs,

the fraudulent firmware would still remain on the Z80 CPU. (Appel Test., 2/5 Sealed Trial Tr. at 13:25 to 14:9; Ex. P-38; Pa849.)

There are two main ways of creating a fraudulent Z80 chip. The first, and easiest, is using a cheap, commonly available computer component called a field programmable gate array, or FPGA. (Wolf Test., 5/11 Trial Tr. at 33:9-14, 41:17-20, 51:14 to 52:3; Wolf Report, ¶ 16, 18-19; Ex. P-117; Pa1199-1201.) An FPGA is nothing more complex than a device that can be programmed to emulate other chips. (Appel Test., 1/29 Trial Tr. at 21:1-9.) An FPGA capable of emulating a Z80 processor is available for $13, and software which can enable it to emulate a Z80 processor is available for free on the Internet. (Appel Test., 1/29 Trial Tr. at 21:12-19; 22:4-9.) Appellees' witness, Paul Terwilliger, admitted that this is the case, that it is called the "T80 project," and that it is freely available for download from http://www.opencores.org. (See D-23.) Further, Dr. Shamos agrees that people have created computer programs to emulate the Z80 processor on hardware other than the Z80. (Shamos Test., 3/25 Trial Tr. at 159:15-21.)

Prof. Appel testified that it would take a person with the level of skill of a Bachelor of science in computer engineering to create a fake Z80 chip with this method. (Appel Test., 1/29 Trial Tr. at 22:10-18.) Prof. Wolf, who has designed chips using

this method, believed that it would take one of his undergraduate students approximately 56 hours to write firmware to create a fraudulent Z80 chip using this method. (Wolf Test., 5/11 Trial Tr. at 32:16 to 33:2; Wolf Report, ¶ 23; Ex. P-117; Pa1202-03.) Prof. Wolf testified that a Xilinx FPGA capable of emulating a Z80 is available for a retail price of $15.84 for a single unit. (Wolf Test., 5/11 Trial Tr. at 34:21-24, 38:10-20; Wolf Report, ¶ 26; Ex. P-117; Pa1203.) Casing ranges in price from $8 for a plastic case to $55 for a ceramic case. (Wolf Test., 5/11 Trial Tr. at 39:25-7; Wolf Report, ¶ 29; Ex. P-117; Pa1205). These prices come down when one buys in bulk. (Wolf Test., 5/11 Trial Tr. at 34:21-24.) Prof. Wolf also testified that the per unit cost of mass producing these fraudulent chips and putting them into a plastic case designed to look like a legitimate Z80 processor would be $70 per unit over a run of 500 chips. (Wolf Test., 5/11 Trial Tr. at 53:4-15; Wolf Report, ¶ 30; Ex. P-117; Pa1205.)

The second way of creating a fraudulent Z80 chip would be to design the chip from the ground up, using VLSI methods[4] commonly available in the computer engineering field. (Wolf

[4] VLSI is Very-Large-Scale Integration, a name for the process of creating microprocessors, like the Z80, which use thousands of transistor-based circuits. The technique was more common in the 1970s, when simple processors like the Z80 were state of the art, than now, when microprocessors often contain hundreds of millions of transistors.

Test., 5/11 Trial Tr. at 13:16-24, 20:8-14, 40:8-41:6; Wolf Report, ¶ 31; Ex. P-117; Pa1205-06.) Such a chip would be absolutely identical in appearance to a legitimate Z80 chip, and literally could not be detected by any practical method. (Id.) As the Z80 is a 30-year-old chip, its design features are well-known to the computer engineering community. (Wolf Test., 5/11 Trial Tr. at 27:1-10; Wolf Report, ¶ 53; Ex. P-117; Pa1215.) A computer engineer of normal skill would be able to design a completely undetectable fake Z80 chip from the ground up in six months or less. (Wolf Test., 5/11 Trial Tr. at 32:16 to 33:5; Wolf Report, ¶ 35 at 18; Ex. P-117; Pa1207.) Prof. Wolf estimated the cost to the attacker as ranging from $640 per unit for a run of 500 units to $80 per unit for a run of 10,000 units. (Wolf Test., 5/11 Trial Tr. at 42:15-25; Wolf Report, ¶ 38; Ex. P-117; Pa1208-09.)

4. The Sequoia 9.00H Is Unreliable Because Fraudulent Firmware Can Easily Create Redundant, Identical Records Which All Agree, And Render Fraudulent Election Results Completely Unauditable.

When the Sequoia AVC Advantage 9.00H DRE records a vote, it does so in multiple steps, creating redundant, identical records of the transaction:

- The DRE adds the vote to the audit trail file on the motherboard;

- then, it adds the vote to the candidate totals on the internal memory on the motherboard;
- then, it adds the vote to the audit trail file on the results cartridge;
- finally, it adds the vote to the candidate totals on the results cartridge. (Appel Test., 2/9 Trial Tr. at 21:19 to 22:3.)

Prof. Appel's fraudulent firmware follows the same pattern, creating four records which all agree with each other. (Appel Test., 1/28 Trial Tr. at 111:14-24.) However, the results are fraudulent. (Appel Test, 1/28 Trial Tr. at 111:14 to 113:10.) Because these four records are the only record of what actually happened in the election, there is no way to verify after the fact that the results are real, rather than the product of fraudulent firmware. (Appel Test., 1/28 Trial Tr. at 121:15 to 122:5.) There is also no practical way to detect fraudulent firmware.

5. The Sequoia 9.00H Is Unreliable Because The Skills Needed To Create And Install Fraudulent Firmware On It Are Common.

Appellants' experts, expressing the scientific consensus, made very clear that the experience necessary to create fraudulent firmware for the Sequoia Advantage 9.00H and to install it is common in modern American society. (See Appel Test., 1/28 Trial Tr. at 126:13-23; Appel Report, § 7.1, at 26; Ex. P-2; Pa558.)

Prof. Appel testified that picking the locks on the Sequoia AVC Advantage 9.00H is very simple. (Appel Test., 1/28 Trial Tr. at 83:18 to 84:10; DVD 4 Tape 5, at 5:58 to 8:19; Ex. P-6; Pa731.) Despite having no experience picking locks, he was able to learn how to do it in less than a half-hour. (Appel Test., 1/28 Trial Tr. at 79:12-19.) Prof. Appel estimated that anyone with a bachelor's degree in computer science or computer engineering would possess the level of skill necessary to create a fraudulent ROM chip. (See Appel Test., 1/28 Trial Tr. at 126:13-23; Appel Report, § 7.1, at 26; Ex. P-2; Pa558.) Approximately 25,000 people in the United States earn bachelor of science degrees in computer science. (Appel Test., 1/28 Trial Tr. at 78:3-5.) Anyone with a technician's level of skill could perform other phases of the hack, such as replacing a Z80 chip which is soldered onto the motherboard. (Appel Test., 1/28 Trial Tr. at 78:3-5.)

Prof. Wolf testified that a senior undergraduate student learning logic design would be capable of designing a fraudulent Z80 chip from the ground up using VLSI methods. This chip would be virtually indistinguishable from the real thing. (Wolf Test., 5/11 Trial Tr. at 13:16-24, 20:8-14, 40:8-41:6; Wolf Report, ¶ 31 at 16; Ex. P-117; Pa1205.)

The field programmable gate array, or FPGA method, is even simpler. Prof. Wolf testified that even a junior undergraduate

student in the field would be able to design a fraudulent Z80 chip using an FPGA. (Wolf Test., 5/11 Trial Tr. at 33:9-16.) Prof. Wolf estimated that there are half a million people in the world with the computing skills necessary to design and implement a fraudulent Z80 processor.[5] (Wolf Test., 5/11 Trial Tr. at 13:16-24, 20:8-14, 40:8-41:6; Wolf Report, ¶ 31 at 16; Ex. P-117; Pa1205.)

Prof. Wayne Wolf testified that it is almost impossible to detect a fraudulent Z80 chip. (Wolf Test., 5/11 Trial Tr. at 23:4-18, 45:18 to 46:18, 46:19-25.) Dr. Shamos agrees with Prof. Wolf and testified that "you can't easily determine . . . whether you have a very cleverly faked Z80 that has defenses against being detected." (Shamos Test., 3/24 Trial Tr. at 64:13-15.)

Some hacks Prof. Appel testified about require less skill to devise and effectuate. (Appel Test., 4/14 Sealed Trial Tr. at 44:13-14.) For example, virtually anyone familiar with how normal DOS-based computers operate could write a virus to infect the daughterboard, and anyone with the level of skill of a Bachelor's degree in computer science could write a virus to disable AVC Advantage 9.00H DREs selectively. (Appel Test.,

[5] Embedded computing is when computing devices are embedded into other pieces of hardware for use in real time, like microwaves, automobiles, and electronic voting machines. (Appel Test., 1/29 Sealed Trial Tr. at 5:5-8.)

1/29 Sealed Trial Tr. at 13:1-3, 91:7-20; Appel Report, § 25.1, at 71; Ex. P-2; Pa602.)

6. The Sequoia Advantage 9.00H Daughterboard Is Particularly Unreliable.

a. The Daughterboard Is Another Computer Inside The DRE.

The Sequoia AVC Advantage 9.00H DRE contains another computer besides the Z80-based computer on the motherboard. (Appel Report § 60.1 at 130; Ex. P-2; Pa661; Terwilliger Test., 3/30 Trial Tr. at 107:24 to 108:7.) In 2003, Sequoia installed a more powerful computer in the DRE. Its purpose was to support audio functions beyond the abilities of the Z80. (Appel Report § 60.2 at 130; Ex. P-2; Pa661.) In sum, Sequoia AVC Advantage 9.00H DRE has two separate but connected computers: an Intel 486-based computer sits on a daughterboard which is plugged into the motherboard containing the Z80 CPU processor. (Appel Report § 60.7 at 131; Ex. P-2; Pa662.)

The newly added daughterboard is significantly more vulnerable to attack because its firmware is stored in flash memory. (Appel Report, § 19.10, at 58; Ex. P-2; Pa590.)

b. The Daughterboard's Use of Flash Memory to Store Firmware is Extremely Insecure and Unreliable.

The daughterboard uses an external cartridge to install audio ballots – a recorded list of candidates and ballot issues that visually impaired voters listen to in order to cast their

votes. (Appel Test., 1/28 Trial Tr. at 7:17-19, 8:8-13, 61:12-15; Appel Report, § 19.5, at 56-57; Ex. P-2; Pa588-89.) However, the same kind of card can be used to replace legitimate firmware on the daughterboard with fraudulent firmware. (Appel Test., 1/28 Trial Tr. at 61:10-17.)

If that is done, the fraudulent firmware can infect any legitimate cartridge inserted into the audio ballot cartridge slot and spread the infection further. (Appel Test., 1/29 Trial Tr. at 73:14-21; Appel Report, § 20.6.2, at 60; Ex. P-2; Pa592.) Simply putting a cartridge containing fraudulent firmware into the audio ballot cartridge will cause the DRE to copy the fraudulent firmware to the flash memory on the daughterboard. (Appel Test., 1/28 Trial Tr. at 61:10-17, Appel Test., 1/29 Trial Tr. at 3:15-19; Appel Report, § 20.6.1, at 60; Ex. P-2; Pa592.) Every DRE in the county or the State could become infected by a single corrupted audio ballot cartridge. (Appel Test., 1/29 Trial Tr. at 72:25 to 73:3.)

Dr. Shamos agrees with Prof. Appel that this is a severe flaw. (Shamos Report ¶ 102, at 24; Ex. D-21.) Similarly, Mr. Terwilliger agrees that flash memory is particularly susceptible to being rewritten. (Terwilliger Test., 3/30 Trial Tr. at 109:15-21.)

c. Connecting WinEDS Computers To The Internet Multiplies The Danger Of Daughterboard Viruses.

The insecurity of the daughterboard is magnified when combined with the vulnerabilities of WinEDS because viruses can spread between the DREs and the WinEDS computers. (Appel Test., 1/28 Trial Tr. at 65:14-18.) A virus could come over the Internet, attack WinEDS computers, and spread to DREs. (Appel Test., 1/28 Trial Tr. at 65:7-13.) An innocent election worker performing routine duties can just as easily (but inadvertently) spread the infection as a corrupt election worker. (Appel Test., 1/28 Trial Tr. at 65:18-21.) The mere physical act of inserting a cartridge into a WinEDS computer or Advantage 9.00H DRE spreads the virus. (Appel Test., 1/28 Trial Tr. at 61:10-17.) If either the WinEDS computer, the DRE, or the cartridge are infected, the infection will spread. (Appel Test, 1/28 Trial Tr. at 61:10-17, Appel Test., 1/29 Trial Tr. at 3:15-19, 72:25 to 73:3, 73:10-21, 73:25 to 74:3; Appel Report, § 20.6.1, at 60.)

This automatic copying mechanism is not selective. It will spread fraudulent firmware deliberately created in order to steal votes. (Appel Test., 1/28 Trial Tr. at 61:10-17.) It will also spread viruses inadvertently caught from the Internet. (Appel Test., 1/28 Trial Tr. at 66:14-18.)

Dr. Shamos agrees with Prof. Appel that WinEDS computers should never be connected to the Internet. (Shamos Test., 3/23 Trial Tr. at 153:22 to 154:2.) Even the Sequoia employee witnesses, Smith and Terwilliger, agree that this should never occur. (Smith Test., 3/18 Trial Tr. at 32:19-22.)

The Internet files on the Union County laptop Prof. Appel examined prove that WinEDS computers are frequently connected to the Internet, even on election days. (Appel Test., 1/28 Trial Tr. at 61:18 to 63:24.) This is not an isolated occurrence. Mr. Mahoney (Bergen County), Ms. Gentile (Hudson County), and Ms. Sollami-Covello (Mercer County) all gave testimony that WinEDS computers in their counties are connected to the Internet. (Mahoney Test., 2/23 Trial Tr. at 111:20-22, Gentile Test., 2/23 Trial Tr. at 56:16-23, Sollami-Covello Test., 2/24 Trial Tr. at 87:15-17.) Moreover, Mr. Giles testified that there is no State policy requiring that voting systems not be connected to the Internet. (Giles Test., 3/3 Trial Tr. at 157:17-25.)

Because the daughterboard is used to tabulate the votes of the visually impaired, those votes are especially vulnerable to theft. Fraudulent firmware can alter the votes of the visually impaired, and transmit the fraudulent results to the motherboard,

with no way ever to determine what the voters' actual intentions were.[6]

Viruses or fraudulent firmware in the daughterboard can also affect all voters. Viruses can cause the entire DRE to shut down. This can lead to long lines or even chaos on election day.

7. Even When Operated As Intended, The Sequoia AVC Advantage DRE Is Unreliable.

a. The Option Switch Bug Has Disenfranchised New Jersey Primary Voters.

On Super Tuesday, February 5, 2008, at least 37 Advantage 9.00H DREs malfunctioned in eight counties. This disenfranchised

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[6] In the AVC Advantage 10 DRE, which Sequoia developed in 2009, Sequoia moved most of the DRE's functionality to the daughterboard. (Terwilliger Test., 3/30 Trial Tr. at 107:24 to 108:7.) Thus, in the D-10 the daughterboard is the main computer for the DRE and reducing the motherboard is reduced to a mere appendage. (Terwilliger Test., 3/30 Trial Tr. at 113:2-5.)

Mr. Terwilliger admits that if he were to design a DRE anew, it would not be the D-10. (Terwilliger Test., 3/30 Trial Tr. at 113:6-8.)

The daughterboard of the 9.00H DRE is susceptible to vote-stealing viral infection. (Appel Report, § 19.10, at 56-57; Ex. P-2; Pa590.) It mostly handles the votes of visually impaired voters. (Appel Test., 1/28 Trial Tr. at 7:17-19, 8:8-13, 61:12-15;Appel Report, § 19.5, at 56-57; Ex. P-2; Pa588-89.) But, in the AVC Advantage 10, the same insecurities affecting the votes of the visually impaired will threaten all voters. Even Appellees' expert, Dr. Shamos, believed that this defect was extremely severe and required immediate remediation. (Shamos Test., 3/25 Trial Tr. at 35:4-7.) Making this extremely insecure daughterboard computer the main computer in the Advantage 10 DRE allows an attacker to steal everyone's votes and not just the votes of the blind. (Shamos Rebuttal ¶ 102, at 24.)

voters. (Appel, Report, § 56.1, at 115; Ex. P-2; Pa646.) It also illegally allowed voters to cast votes in the primary election of the party in which they were not registered to vote. (Id.) This problem was attributed to the "option switch bug."

The first clue to the existence of this bug appeared after the close of elections on February 5, 2008, when Joanne Rajoppi, the Union County Clerk, noticed that the results tape data and the summary report data did not completely agree, in at least nine districts in Union County which use the Advantage 9.00H DRE. (Rajoppi Test., 2/26 Trial Tr. at 66:17-22. 83:5-10.) Further, in five of the nine districts, there were fewer voter authority slips than votes on the results cartridge, meaning more votes were cast than there were voters. (Id. at 75:10-15.)

As a result of the option switch bug, vote totals for each party disagree with the candidate total figures. For example, in Union County, one DRE reported 361 votes for Democratic candidates, but reported that 362 Democratic voters had cast a vote. (Appel Test., 2/4 Trial Tr. at 30:7-10; Appel Report, § 56.11-13, at 118; Ex. P-2; Pa649; Exs. P-25 and P-26; Pa765-66.) The same DRE reported 61 total votes for Republican candidates, but reported that 60 Republican votes had been cast. (Appel Test., 2/4 Trial Tr. at 32:23 to 33:12.) Both of these results should be impossible. (Appel Test., 2/4 Trial Tr. at

34:5-8, 32:23 to 33:17; Appel Report, § 56.11-13, at 118; Ex. P-2; Pa649.)

The ballot definition file for the February 5, 2008 primary requires that each voter cast exactly one vote for a candidate of the voter's party. (Id.) It should be impossible for: a) a voter to fail to cast a vote in the primary election; and b) to vote for someone in the opposite party. (Id.)

Ms. Rajoppi was not alone in noticing that the results reports printouts from the Advantage 9.00H DREs were clearly erroneous. (Sollami-Covello Test., 2/24 Trial Tr. at 71:2-6.) Paula Sollami-Covello, the Mercer County Clerk, also inspected the results reports printouts from the Advantage 9.00H DREs and noticed the same erroneous results. (Sollami-Covello Test., 2/26 Trial Tr. at 19:17-20; Sollami-Covello Test., 2/24 Trial Tr. at 67:2-8, 70:1, 71:12-13.) For the February 5, 2008 Presidential primary, the results reports from 30 Sequoia AVC Advantage 9.00H DREs disagreed with the results cartridges from the same election. (Sollami-Covello Test., 2/24 Trial Tr. at 71:12-13.) On 30 DREs, there were more votes than voters. (Sollami-Covello Test., 2/24 Trial Tr. at 67:13-16.) On 27 of those DREs, the number of overvotes for one party equaled the undervotes for the other party. (Sollami-Covello Test., 2/26 Trial Tr. at 6:6-15, 9:2.) Voters who were registered Republicans had been presented with the Democratic slate of candidates, and vice versa. (See id. at

6:12-15.) Multiple Democrats attempted to write-in "Hillary Clinton" in the Republican primary. (Sollami-Covello Test., 2/26 Trial Tr. at 30:25-31:12.) These votes were not counted, because Democratic voters may not vote in the Republican primary. (Id.)

Prof. Appel subsequently found that the option switch bug causes the Advantage 9.00Hs to behave incorrectly when a poll worker (accidentally or deliberately) presses a button on the operator panel of the DRE while activating the voting machine for a primary election. (Appel Test., 1/29 Trial Tr. at 157:22 to 158:2.) When the bug is triggered, the "option switch" for the voter's party is correctly activated. The option switch counts how many voters for each party used the DRE during the election. (Appel Test., 1/29 Trial Tr. at 157:14 to 158:2; 159:15-19; 161:1-12; Appel Report, § 56.22, at 121.) However, the DRE will not allow a voter to vote in the correct party primary. (Id.) Instead, the bug causes the DRE to activate the slate of candidates for the other party. (Id.) So, in violation of State law, a Republican is allowed to vote for a Democratic candidate in the Democratic primary, and vice versa. (N.J.S.A. § 19:23-45.)

Witnesses on both sides, including Dr. Shamos, agree that this is a serious problem which disenfranchised voters on Super Tuesday, and that it could be exploited to disenfranchise

voters. (Shamos Test., 3/25 Trial Tr. at 37:24 to 38:21.) As Dr. Shamos simply stated, "it's bad." (Shamos Test., 3/24 Trial Tr. at 114:3-15.)

The option switch bug makes the DRE unreliable because voters are prevented from voting in their party's primary, and they are permitted to vote in the opposite party's primary. (Appel Test., 1/29 Trial Tr. at 157:14 to 158:2; 159:15-19; 161:1-12; Appel Report, § 56.22, at 121.) This also violates N.J.S.A. § 19:23-45 (requiring that voters in primary elections be allowed to cast vote in their party and no other).

b. County Clerks And Other Constitutional Officers Doubt The Reliability Of The Sequoia Advantage And The Validity Of The 2008 Presidential Primary.

Because of the option switch bug, Union County Clerk Joanne Rajoppi did not certify the result of the election in the usual way. (Rajoppi Test., 2/26 Trial Tr. at 88:15-18.) Instead, she expressed reservations about the AVC Advantage's reliability, because she "could not swear that it was accurate." (Id. at 89:19-23.) Ms. Rajoppi tried to contact the Attorney General's office three to four times over the course of a month, and spoke to different individuals about the option switch bug, including Donna Kelly or someone in Donna Kelly's office. (Id. at 84:3-12, 84:20 to 85:6.) The Attorney General's office never even bothered to contact Ms. Rajoppi. (Id. at 85:20 to 86:23.) Ms.

Rajoppi also attempted to contact Sequoia to discuss her concerns about the reliability of the Sequoia Advantage. (Id. at 83:24-84:2, 87:21-23.) Those attempts were also rebuffed. (Id. at 89:7, 11-15.)

Similarly, Ms. Sollami-Covello, the Mercer County Clerk, attempted to contact a number of State officials, including members of the Attorney General's office. (Sollami-Covello Test., 2/24 Trial Tr. at 73:19-25, 74:1-3.) The Attorney General's office failed to respond to Ms. Sollami-Covello. (Sollami-Covello Test., 2/24 Trial Tr. at 75:24-25, 76:1.) Ms. Sollami-Covello also contacted Joe McIntyre of Sequoia. (Sollami-Covello Test., 2/24 Trial Tr. at 74:18-21.) Sequoia's only response was a press release attempting to explain the error. (Sollami-Covello Test., 2/24 Trial Tr. at 76:2-8.)

Ms. Rajoppi testified that she experienced additional problems with the Advantage DRE since she discovered the option switch bug. (Rajoppi Test., 2/26 Trial Tr. at 105:5, 111:13 to 112:3, 113:15-16, 115:15-18.) In particular, she received many complaints from members of the public, including the Mayor of Springfield, about the behavior of the Sequoia AVC Advantage 9.00H DREs in the November 2008 general election. (Id. at 117:15 to 120:13.) The voting machine also rejected an Hispanic candidate's name in the June 2008 primary election. (Id. at 105:5, 103:16-20.)

As a result, Ms. Rajoppi has been hindered from carrying out her duties under the New Jersey Constitution. (Id. at 102:19 to 103:2.) While she continues to certify elections, she harbors grave doubts about the reliability and accuracy of the results reported by the 9.00H DREs. (Id.)

Ms. Rajoppi is far from alone in her concerns about the unreliability and inaccuracy of the Sequoia AVC Advantage 9.00H DREs. The Constitutional Officers Association, a New Jersey organization of elected State constitutional officers such as Sheriffs, County Clerks, Surrogates and Registers of Deeds and Mortgages, passed a resolution calling for an independent investigation of the inaccurate election results produced by the Advantage 9.00H DREs. (Id. at 92:11-13.) The Association then conveyed this sentiment via formal letter to the Attorney General's office. (Id. at 92:13-14.) Ms. Rajoppi also attempted to retain Prof. Felten of Princeton to investigate the unreliable 9.00H DREs further. (Id. at 97:24.) Rather than assist the attempt to investigate, the Office of the Attorney General discouraged Ms. Rajoppi from proceeding. (Id. at 100:19-20, 102:3-7.)

c. Protections Against The Option Switch Bug Have Not Been Adequately Addressed By The State Or Sequoia.

Despite the abundant evidence that the option switch bug is a real problem, the Appellees have done little to remediate it.

(Smith Test., 3/18 Trial Tr. at 129:9, 186:12-19.) Sequoia's Mr. Smith, testified that even he believes the option switch bug is "a real problem." (Smith Test, 3/18 Trial Tr. at 129:9.) Sequoia's Mr. Terwilliger testified that Sequoia has taken no action to remediate the option switch bug in the Advantage 9.00H DREs used in New Jersey. (Terwilliger Test., 3/30 Trial Tr. at 125:5-9.)

Another of Appellees' witnesses, Mr. Clayton, testified that Sequoia's proffered "solution" to this software bug is to attach a piece of plastic to the DRE with velcro in an attempt to prevent poll workers from pressing the buttons which trigger the bug. (Clayton Test., 3/3 Trial Tr. at 85-87.) This underscores the State's band-aid approach to deep, systemic problems.

This solution is not enough and does nothing to remedy the unreliability caused by the option switch bug. Mr. Clayton testified that there is no protocol to ensure that this plastic shield is actually on the Advantage 9.00H DREs when they are in use. (Clayton Test, 3/3 Trial Tr. at 86:3-9.) Mr. Smith testified that this piece of plastic was the only attempt made to remediate the option switch bug. (Smith Test., 3/18 Trial Tr. at 129:8 to 130:22.) A piece of plastic attached by velcro clearly does not prevent poll workers from inadvertently or purposely triggering the bug. Moreover, there is no protocol in

place to let poll workers know to keep the piece of plastic in place. (Clayton Test., 3/3 Trial Tr. at 85:23 to 86:2.)

8. Many Other Bugs And Sloppy Software Practices Make The Sequoia Advantage 9.00H Unreliable.

a. The Buffer Overrun Bug Can Shut Down The Advantage.

Another bug Prof. Appel discovered is the buffer overrun bug. That bug commonly occurs in badly written software. (Appel Test., 2/4 Trial Tr. at 19:16 to 20:10.) A buffer overrun bug occurs when software allows ill-formed input to cause unexpected results. (Id.) Sequoia's buffer overrun bug, described in Appendix B of Prof. Appel's report, allows the DRE to be completely disabled by a virus on the daughterboard. (Id.) Effectively, the daughterboard sends a malformed message to the motherboard, causing the DRE to enter an endless cycle of resetting itself. (Id.)

Dr. Shamos agrees that the buffer overrun bug which allows the daughterboard to cause the Advantage 9.00H DRE to crash is a serious error which needs to be remediated immediately. (Shamos Rebuttal ¶ 102, at 24.) Dr. Shamos further agrees that because of the insecurity of WinEDS and the daughterboard, an attacker does not need even to get near to the Advantage 9.00H DRE to infect it with a virus. (Appel Report, §61.7, at 134.)

b. Known Sloppy Practices And Bugs Make It More Likely That There Are More Bugs In The 9.00H.

The Advantage 9.00H source code reveals that the 9.00H firmware is likely to contain more bugs. (Appel Test., 1/29 Trial Tr. at 127:5-9.) Because of the limited amount of time and the necessity to explain known bugs and demonstrate fraudulent firmware, Prof. Appel and his team were unable to examine the source code exhaustively for more bugs. (Appel Test., 1/29 Trial Tr. at 147:4 to 148:3; Appel Report, § 54.12, at 114.)

However, even if Prof. Appel and his team had the time for an exhaustive examination of the 130,000 lines of source code, they would still not be sure that they detected all the bugs, or even fraudulent firmware. (Id.) This is because there is software running in the Advantage for which Sequoia claims it does not have source code. This means that Sequoia has no idea what is actually running in the AVC Advantage 9.00H. (Appel Test., 1/29 Trial Tr. at 148:19-25; Appel Report, § 54.13, at 114; Pa645.) This fails to meet the standard of New Jersey law, which requires that a voting machine be "thoroughly tested" and "reliable." N.J.S.A. 19:48-1. One cannot test what one does not even know exists.

Appellees' witness, Mr. Smith, admits that the Advantage 9.00H DRE contains software from third-party vendors which is not independently tested by Sequoia. (Smith Test., 3/18 Trial

Tr. at 179:5-13.) Mr. Smith does not know which vendors provide that software, but stated that he believes, but is not certain that in addition to software from Microsoft and Datalight, one of the vendors has the word “General” in its name. (Id.)

Even without Sequoia’s disturbing admission that it does not know what software is running in the Sequoia AVC Advantage 9.00H, the sloppy software practices embodied in the 9.00Hs source code cast grave doubt on the security and reliability of the Advantage. (Appel Test., 1/29 Trial Tr. at 127:5-9.) In addition to using an obsolete version of the C programming language, which cannot be tested with modern error detection tools, Sequoia’s source code is a confusing mess which is very difficult for subsequent programmers to understand and fix when the DRE misbehaves. (Appel Test., 1/29 Trial Tr. at 18:7-15; Appel Report, § 51.7, at 107 n.96; Pa638.) This deficient software is also, as a result, more vulnerable to attack. (Appel Test., 2/4 Trial Tr. at 5:25 to 6:2.) Dr. Shamos admits that Sequoia’s software development practices in designing the Advantage 9.00H DRE were poor. (Shamos Test., 3/24 Trial Tr. at 171:1-13.) These poor practices, as a whole, weaken the integrity of the entire voting system and make it unreliable. (Appel Test., 2/4 Trial Tr. at 5:25 to 6:2.) We do not know the full extent of the unreliability.

9. The Sequoia AVC Advantage 9.00H Is Unreliable Because It Falsely Tells Voters That Votes Are Recorded When They Are Not.

The AVC Advantage 9.00H user interface is deeply flawed, and issues confusing, misleading, or outright false messages to the voter. (See generally Appel Test., 1/29 Trial Tr. at 176:3-20, 174:11-16; Appel Report, § 38.1, at 87; Pa618.) One of the worst of these flaws is that it falsely indicates to the voter that a vote has been counted when the machine is not activated and not counting votes. (Appel Test., 1/29 Trial Tr. at 183:9 to 185:3, Appel Report, § 30.1, at 79; Pa610; Appel Test., 1/29 Trial Tr. at 177:24 to 178:4; DVD 1 Tape 1, at 17:30 to 18:14; Pa728.)

Even when the AVC Advantage 9.00H is not activated and cannot count votes, the DRE gives multiple false indications to the voter that a vote has been counted. (Id.)

For example:

- the DRE lights the green X by a candidate's name when the button for that candidate is pressed;
- the Cast Vote button lights up when it is pressed;
- and the LCD panel displays the message "VOTE RECORDED THANK YOU," just as if a vote had been cast. (Id.)

Whether the poll worker fails to activate the DRE accidentally or deliberately, voters seeing the signals listed

above could very well be tricked into losing their votes. (Appel Report, § 30.7, at 80; Pa611; DVD 1 Tape 1, at 18:34 to 19:55; Pa728.)

The option switch bug, discussed above, is another way that the DRE gives false signals to a voter that she has voted, when in reality, she has not. If a poll worker, either inadvertently or maliciously, presses a button on the operator panel after activating the DRE, but before a voter casts a vote, it will silently deactivate the DRE. (Appel Test., 1/29 Trial Tr. at 185:17 to 186:8; Appel Report, §31.1, at 80; Pa611.) The vote will not be counted. (Appel Test., 1/29 Trial Tr. at 185:17 to 186:8; Appel Report, §31.3, at 81; Pa612.) However, the DRE will give multiple indications to the voter that a vote has been counted, including the false "VOTE RECORDED THANK YOU" message on the LCD panel. (Appel Test., 1/29 Trial Tr. at 183:9 to 185:3, Appel Report, § 30.1, at 79; Pa610; Appel Test., 1/29 Trial Tr. at 177:24 to 178:4; DVD 1 Tape 1, at 17:30 to 18:14; Pa728.)

These user interface design flaws are not simply theoretical concerns. Appellant Stephanie Harris testified that the first time she attempted to vote on a Sequoia AVC Advantage DRE, she chose her candidates, pressed the "CAST VOTE" button, and exited the voting booth. (Harris Test., 1/27 Trial Tr. at 71:13 to 72:8, 72:11-73:4.)

A poll worker informed her that her vote was not counted, and requested that she try to vote a second time. (Harris Test., 1/27 Trial Tr. at 73:10-14.) This sequence of events repeated two more times. (Harris Test., 1/27 Trial Tr. at 73:13-18.) The last time, the poll worker told Ms. Harris that he thought the DRE registered her vote. (Id.)

Neither the poll worker nor Ms. Harris had any means to be certain that Ms. Harris' vote actually was cast. (Harris Test., 1/27 Trial Tr. at 73:16-18.) Ms. Harris testified that since then, she cannot rely on Sequoia AVC Advantage DREs to count her votes correctly. (Harris Test., 1/27 Trial Tr. at 74:3-7.) Dr. Shamos agrees that the user interface of the AVC Advantage 9.00H DRE is poorly designed in many ways and that "the vendor should be compelled to produce a better interface[.]" (Shamos Rebuttal, ¶ 23, at 28.)

10. The Sequoia 9.00H Is Unreliable Because Its Flawed User Interface Can Confuse Voters And Cause Lost Votes.

The primitive buttons-and-lights user interface of the Sequoia AVC Advantage 9.00H DRE can easily cause votes to be lost. (See generally Appel Test., 1/29 Trial Tr. at 176:3-20, 174:11-16; Appel Report, § 38.1, at 87; Pa618.)

For example, even when the DRE is not activated, it will light up a green X next to the name of a candidate when the voter presses that button. (Appel Test., 1/29 Trial Tr. at 174:11-16;

Appel Report, § 38.2, at 87; Pa618.) This falsely conveys to the voter that she has properly selected the candidate of her choice. (Id.) Dr. Shamos agrees that this behavior is "confusing and risky." (Shamos Rebuttal, ¶ 112, at 25-26.) Sequoia has been aware of this problem since 2006, but has not fixed it. (Id.) If the voting machine is not activated, it should not indicate that it is. Any deviation from this common sense principle is evidence of unreliability.

Another problem with the user interface is that it fails to warn voters that they have failed to cast votes for offices or ballot questions for which they are entitled to vote. (Shamos Test., 3/25 Trial Tr. at 39:7-11.) The buttons and lights interface allows no practical way for the DRE to communicate a message about an under vote. Dr. Shamos agrees that this feature is problematic. (Id.) Studies show that this feature on the Advantage has a disproportionate effect on minority voters.[7] (Appel Report, § 33.3, at 83; Pa614; David Kimball, Voting Equipment and Residual Votes on Ballot Initiatives: The 2006 Election in New Jersey, University of Missouri-St. Louis (Feb. 28, 2007.))

[7] Empirical studies have, indeed, shown that elections using the AVC Advantage 9.00H have an unusually large number of undervotes. David Kimball, Voting Equipment and Residual Votes on Ballot Initiatives: The 2006 Election in New Jersey, David Kimball (Feb. 2007), available at http://www.umsl.edu/~kimballd/NJ06resid.pdf.

11. The Sequoia AVC Advantage 9.00H Is Unreliable Because It Does Not Allow a Voter to Undo a Write-In Vote, Violating Federal Guidelines.

The Advantage 9.00H DRE provides no means to undo a write-in vote. (Appel Report, § 36.4, at 86; Pa617.) After the voter has used the keypad to enter the name of a candidate, the write-in cannot be unselected. (Id.) This makes the DRE unreliable because a voter is given no warning about this feature. (Id.) A voter may take a different approach if she is made aware that she cannot change her vote.

The inability to change a write-in vote is also a violation of the FEC Guidelines for voting machines, which say: "A means for correcting a vote response should be readily available. For non-paper based systems, this should be built into the design of the system." (Appel Report, § 36.2, at 86; Pa617; VVS 2002, App. C, sec. C.8(e).) Dr. Shamos agrees that the law requires that the Advantage 9.00H DRE allow the voter to correct a write-in vote, but that it does not do so. (Shamos Test., 3/25 Trial Tr. at 47:8 to 48:23.)

The result of this design flaw is that these voters are more likely to be disenfranchised because they are unable to cast their desired votes. (Appel Report, § 33.5, at 83; Pa614; Appel Report, App. I, at 149-51 for more discussion of the lack of under-vote warnings; Pa680-82.)

12. Prof. Appel Testified About Other Serious Flaws In The Sequoia AVC Advantage 9.00H DRE That Make It Unreliable.

The list of flaws Prof. Appel detailed in his expert report and in his testimony is long and meticulously detailed. (Appel Test., 1/27 Trial Tr. at 143:18-23.) Some other problems which make the Sequoia AVC Advantage 9.00H DRE unreliable include:

- Manipulation of ballot definition files can reverse buttons for candidates or give two votes to a candidate with every single button press for that candidate. (Appel Test., 2/4 Trial Tr. at 10:13-15; Appel Report, § 43.1, at 94-95; Pa625-26.)

Manipulation of results cartridges by a variety of means can corrupt the records of elections. (Appel Test., 1/28 Trial Tr. at 121:2-6; DVD 1, 18:47.)

The Advantage 9.00H DRE does not give adequate warning to the voter about undervotes, or failing to cast a vote for all races and questions for which the voter is eligible. (Shamos Test., 3/25 Trial Tr. at 39:7-11.)

Vote data is not electronically authenticated by modern, well-known methods to detect whether they have been altered. (Appel Test., 2/4 Trial Tr. at 56:18 to 57:19; Appel Report, § 39.2, at 88; § 39.6, at 89; Pa620.)

Dr. Shamos agrees that Prof. Appel's examination of DREs in New Jersey is essential to their security. (Shamos Test., 3/25 Trial Tr. at 10:2-6.) Further, he testified that "everybody in

the voting field should be concerned about Prof. Appel's findings." (Shamos Test., 3/25 Trial Tr. at 9:22-23.) Dr. Shamos agrees that there are problems with Sequoia's voting software and physical security, and that the AVC Advantage 9.00H in particular has "serious vulnerabilities." (Shamos Test., 3/23 Trial Tr. at 95:12-15.) Dr. Shamos agrees these problems need to be remedied. (Shamos Test., 3/25 Trial Tr. at 10:12-25.)

B. The Sequoia Advantage WinEDS Vote Tabulating System Is Not Reliable.

1. The WinEDS System Is Unreliable Because It Cannot Ascertain Whether DREs Have Been Corrupted.

As Prof. Appel demonstrated, when fraudulent firmware steals votes, it writes the fraudulent results it creates to four places. (Appel Test., 1/28 Trial Tr. at 111:14-24.) Vote totals are written to the results cartridge and the memory on the motherboard, and ballot images, the so-called "audit trail," are also written to the results cartridge and the memory on the motherboard. (Appel Test, 1/28 Trial Tr. at 111:17 to 112:13.) The results cartridge is used to transfer vote totals from precincts to county offices to be totaled by the WinEDS software. (Appel Test., 1/28 Trial Tr. at 6:14-19.)

The Sequoia AVC Advantage 9.00H DRE and the WinEDS software used to tabulate votes after an election do not have any method of authenticating the data from results cartridges to ensure that

they are not the product of fraudulent firmware. (Appel Report, § 39.8, at 89 n.82; Ex. P-2; Pa620.) Similarly, if results cartridges are altered in transit, the WinEDS computer cannot detect that fraud. (Appel Test., 2/4 Trial Tr. at 60:15 to 62:18; Appel Report, § 39.8, 89; Ex. P-2; Pa620.) Indeed, when confronted with a results cartridge loaded with fraudulent data, the WinEDS computer will accept it without question and tabulate it just as it would legitimate data from a results cartridge. (Appel Test., 1/28 Trial Tr. at 121:2-6; DVD 1, 18:47; Ex. P-3; Pa728.)

There are methods of generating a cryptographic signature for a document which proves its origin. (Appel Report, § 39.3, at 88-89; Ex. P-2; Pa619-20.) Prof. Appel testified that although digital signatures exist, and Sequoia's marketing literature claims that the Advantage 9.00H employs such technologies, there are, in fact, no digital signatures to ensure the authenticity of results cartridge data. (Appel Report, § 39.8, at 89 n.82; Ex. P-2; Pa620.) Therefore, there is no way to verify the authenticity of vote total data on results cartridges or on the motherboard of the Advantage 9.00H DRE. (Appel Test., 2/4 Trial Tr. at 56:18 to 57:19; Appel Report, § 39.2, at 88; § 39.6, at 89; Ex. P-2; Pa619.)

The Union County Clerk, Joanne Rajoppi, has encountered serious problems in the operation of the WinEDS system. (Rajoppi

Test., 2/26 Trial Tr. at 111:13 to 112:3, 113:15-16, 115:15-18.) This causes her to doubt the reliability of the Sequoia AVC Advantage 9.00H DRE and the accuracy of the election totals it generates. (Rajoppi Test., 2/26 Trial Tr. at 110:23-25, 65:24 to 66:11.) In the November 2008 general election, Ms. Rajoppi discovered that the WinEDS computer lost the results from all 438 Union County ballot cartridges that election workers had tabulated the night before. The election results had been "zeroed out." (Rajoppi Test., 2/26 Trial Tr. at 111:13 to 112:3, 113:15-16, 115:15-18.) She and her staff had personally entered results manually the previous night and could re-create the data. (Rajoppi Test., 2/26 Trial Tr. at 117:1-2.) But she still does not understand how the results were erased by WinEDS. (Rajoppi Test., 2/26 Trial Tr.at 114:9-17.)

2. The Sequoia Advantage WinEDS System Is Unreliable Because A Bug In WinEDS Causes The Advantage 9.00H DRE To Fail To Report Candidate Vote Totals.

Ms. Rajoppi testified about a bug that caused Sequoia AVC Advantage 9.00H DREs to fail to report vote totals for Carlos Cedeño, a candidate for the Union County Board of Chosen Freeholders, despite the fact that he was on the ballot and received votes. (Rajoppi Test., 2/26 Trial Tr. 103:10-22.) Ms. Rajoppi initially thought that the reason for this was the

diacritical tilde in his name. (Rajoppi Test., 2/26 Trial Tr. at 103:16-20.)

However, Sequoia's Mr. Smith testified that the real cause of this bug is that WinEDS randomly assigned candidate Cedeño the candidate number "999." (Smith Test., 3/18 Trial Tr. at 133:13 to 134:1.) Mr. Smith also testified that there is no way to know when WinEDS will randomly assign a candidate this number and thereby cause Sequoia AVC Advantage 9.00H DREs to fail to report their vote totals. (Id.)

Shockingly, Mr. Smith testified that Sequoia has been aware of this bug for some time, but chose not to disclose it to the State. (Smith Test., 3/19 Trial Tr. at 79:19-21.) Only after this bug caused the Union County Sequoia AVC Advantage 9.00H DREs to report erroneous vote totals did Sequoia finally issue a product bulletin warning of this bug. (Smith Test., 3/18 Trial Tr. at 134:22.)

III. APPELLANTS HAVE PROVEN THAT THE SEQUOIA ADVANTAGE DREs AND THE WinEDS SYSTEM ARE INSECURE AND READILY ACCESSIBLE TO HACKERS.

A. DREs Can Be Hacked At Polling Places And Warehouses By Insiders, Contract Workers, And The General Public.

Prof. Appel demonstrated how easy it is to replace a ROM chip to make the Sequoia 9.00H cheat in a manner that cannot be detected. (Appel Test., 1/29 Trial Tr. at 16:14-18.) Prof. Wolf testified that it is easy to create, but almost impossible,

to detect a fake Z80 chip that can make the Sequoia 9.00H DRE cheat in elections. (Wolf Test., 5/11 Trial Tr. at 42:11-14, 43:9-12; Wolf Report, ¶ 6; Ex. P-117; Pa1193.) Thus, effective physical security is of the utmost importance to protect the Appellees' DREs. But no such physical security exists.

The Court heard the testimony of three voting machine warehouse workers. That testimony revealed how easy it is for insiders, the general public, and third-party contractors invited into the warehouse by county employees to gain access to the Appellees' DREs.

1. The General Public Can Easily Access DREs At Polling Places And Hack The DREs.

Appellants presented uncontested testimony that DREs are left at polling places unattended for weeks before each election and weeks after every election. The general public can tamper with these unattended DREs and install undetectable vote-stealing software.

From 2004 to 2008, Princeton Prof. Edward Felten took several photographs of himself in front of unattended DREs throughout Mercer County. He took the photographs because, as a computer scientist who has worked on and studied DREs, (Felten Test., 2/10 Trial Tr. at 16:12-13, 17:9-12; see generally Exs. P-39, P-40, P-41, P-42, P-43, P-44, P-45; Pa850-55) and also as a concerned citizen, (id. at 17-19), Prof. Felten was worried

about the security of completely unguarded DREs. (Felten Test., 2/10 Trial Tr. at 27:16-21.)

In the polling places he visited and photographed DREs, the Sequoia Advantage DREs were left unattended. (Felten Test., 2/10 Trial Tr. at 40:3-12; Exs. P-42 (Jadwin Hall), P-43 (Little Brook School), P-44 (Township Hall), and P-45 (Methodist church); Pa853-856.) There were no guards in any of the buildings to watch over the DREs. (Felten Test., 2/10 Trial Tr. at 31:19-22.) All the hallways were unlocked and accessible to the public. (Felten Test., 2/10 Trial Tr. at 18:16-19.) No security badge or key was needed to access any of the buildings housing the DREs, and there were no alarm systems in any of the buildings. (Felten Test., 2/10 Trial Tr. at 45:6-11.) Furthermore, Prof. Felten testified that no one approached him or talked to him as he was observing and photographing the unattended DREs. (Felten Test., 2/10 Trial Tr. at 24:15-18, 26:16-19.)

More disturbing is that, at several locations, there were prominent signs outside the buildings, directing the public to the location of the DREs. (Felten Test., 2/10 Trial Tr. at 46:20 to 47:13, 50:12-16.) Prof. Felten was able to follow these signs directly to the unattended DREs. (Id.)

Other witnesses confirm Prof. Felten's testimony. In Union County, DREs are delivered starting five days before each

Election Day. (Mahoney Test., 2/23 Trial Tr. at 108:20-25.) They are all returned five days after each Election Day. (Mahoney Test., 2/23 Trial Tr. at 109:1-6.) No one signs for the DREs when they are dropped off at the polling locations. (Gentile Test., 2/23 Trial Tr. at 61:12-14.) No one is at the polling sites to receive the DREs. (Gentile Test., 2/23 Trial Tr. at 61:9-11.) No one guards the DREs when they are dropped off at the polling sites. (Gentile Test., 2/23 Trial Tr. at 61:6-14.)

Similarly in Hudson County, Penza Moving Company, an independent contractor, is hired to deliver DREs to polling places before an election and retrieve them after an election. DREs are delivered one week before election day, (Gentile Test., 2/23 Trial Tr. at 61:15-22.), and picked up a week after election day. There is no transfer of custody document. (Gentile Test., 2/23 Trial Tr. at 61:9-11.) Penza employees do not notify the Hudson County supervisor to make her aware that they have delivered the DREs to their respective destinations. (Gentile Test., 2/23 Trial Tr. at 61:6-14.)

Similarly, in Bergen County, the Sequoia Advantage DREs are transported to polling places between ten days and two weeks before each election. (Mahoney Test., 2/23 Trial Tr. at 108:20-25.) The DREs are then left at the polling places for up to two weeks after the election. (Mahoney Test., 2/23 Trial Tr. at

109:1-6.) Bergen County does not provide any security for the DREs during that entire time period. (Mahoney Test., 2/23 Trial Tr. at 109:19-22.)

2. Warehouses Storing DREs Are Insecure.

DREs are stored in warehouses year round that have sub-par and ineffective security. A large sign sits on top of the warehouse stating "Bergen County Voting Machines." (Mahoney Test, 2/24 Trial Tr. at 48:4-19.) There are no evening or weekend security guards at the warehouse. (Mahoney Test, 2/23 Trial Tr. at 89:5-6.) The back door entrance to the building has a three digit code shared by all warehouse employees. (Mahoney Test., 2/23 Trial Tr. at 96:21 to 97:12.) The code for the back door entrance was last changed five years ago. (Id.) Even though each warehouse employee has a different a four digit code for the burglar alarm, Mr. Mahoney's code has not changed since the alarm system was installed 12 years ago, and codes for other employees have not changed since they were hired. (Mahoney Test., 2/23 Trial Tr. at 96:1-7.)

There are eight mechanics employed at the warehouse. They all have unlimited access to the insides of the DREs, and need no authorization to work on the DREs. (Mahoney Test., 2/23 Trial Tr. at 100:7-16.)

Inside the warehouse, the Sequoia Advantage DREs are lined up alphabetically. (Mahoney Test., 2/23 Trial Tr. at 98:12-22.)

On the top of each DRE there is a piece of paper which identifies which town and district they go to. (Mahoney Test., 2/23 Trial Tr. at 98:23 to 99:5.) In the normal course of business, the keys which lock the DREs stay in the DREs. (Mahoney Test., 2/23 Trial Tr. at 99:8-16.) So, if someone were to access the warehouse with the intent of hacking DREs, they would know exactly which ones are going where, and they would not even have to pick the locks of the DREs.

Similarly, before an election, ballot definitions are downloaded from WinEDS. During that time, the backs of the DREs are left open with the DRE keys sitting on top. (Mahoney Test., 2/23 Trial Tr. at 118:10-22.) At this time, anyone in the warehouse would have easy access to the ROM and Z80 chips because warehouse workers have access to the DREs without needing permission.

Bergen County has often lost the keys to DREs during elections. (Mahoney Test., 2/23 Trial Tr. at 118:23-25.) When keys to the Sequoia Advantage DREs are lost, Mr. Mahoney waits until the next election, and if the keys have still not been found he will then replace the locks on the affected DREs. (Mahoney Test., 2/23 Trial Tr. at 119:17-23, 120:23 to 122:6.) During this lag time, someone could access the DREs using the “missing” keys.

Similarly, Ms. Gentile testified that the warehouse holding Hudson County's Sequoia Advantage DREs is not county owned, but rather rented from a Long Island resident. (Gentile Test., 2/23 Trial Tr. at 41:18-23.) There is another tenant on the first floor. (Gentile Test., 2/23 Trial Tr. at 42:16-17.) Six hundred DREs are stored on the second and third floors of the warehouse. (Gentile Test., 2/23 Trial Tr. at 43:6-11.) There are no security video cameras installed at the warehouse entrance. (Gentile Test., 2/23 Trial Tr. at 44:3-5.) There is an alarm system with a 4-digit code and each employee has a separate code, but that code has never been changed. (Gentile Test., 2/23 Trial Tr. at 44:6-24.) There are no overnight or weekend security guards at the warehouse when the county employees are not working. (Gentile Test., 2/23 Trial Tr. at 45:12-15.)

Hudson County's Sequoia Advantage DREs come with two sets of keys which open them. (Gentile Test., 2/23 Trial Tr. at 52:24 to 53:4.) Sets of the keys have been lost in the past. (Gentile Test., 2/23 Trial Tr. at 52:22-23.) There is a duplicate set of keys kept at the warehouse inside a filing cabinet, which was always kept unlocked until Ms. Gentile was deposed for this trial and realized how insecure the keys were. (Gentile Test., 2/23 Trial Tr. at 53:11-18.) There are no written policies for the warehouse employees about locking and unlocking the DREs. (Gentile Test., 2/23 Trial Tr. at 53:22-25.) Before Ms. Gentile

began to lock up the keys to her DREs any visitor to the warehouse, or even an employee, could have easily copied one or all of the keys to the DREs and returned them without anyone noticing.

Before an election and before DREs are sent to polling places, pre-LAT testing is conducted. At this time, the back doors of all DREs are opened and worked on by Election Graphics, an independent contractor chosen by Sequoia. (Gentile Test., 2/23 Trial Tr. at 48:1-4 and 49:18-24.) Any willing person could use this opportunity to hack the DREs.

3. "Insiders" Pose The Greatest Risk To Tampering With The State's Election Equipment.

Appellees' expert, Dr. Shamos, testified that "the principle threat that we worry about is what can insiders do." (Shamos Test., 3/24 Trial Tr. at 114:21 to 115:4, 116:1-3, 116:1-14, 117:24 to 118:2; Shamos Report ¶ 89; Ex. D-21 ("[i]t is of course important to institute procedures to ensure that [] insiders cannot mount the attacks proposed, or to ensure that any intrusion will be detected.")).

According to Dr. Shamos, the insider threat is a legitimate security vulnerability. (Shamos Test., 3/23 Trial Tr. at 116:1-7; Ex. D-21 at ¶ 89.) Dr. Shamos testified that "[a]n insider is someone who has unchallenged authorized access to a system and uses that access in an unauthorized fashion." (Id.)

"Insider threats occur when people who have authorized access to voting equipment do unauthorized things to the voting equipment, but normally they don't have to defeat regular security measures." (Shamos Test., 3/24 Trial Tr. at 114:21 to 115:4, 116:1-3, 116:1-14, 117:24 to 118:2; Shamos Report ¶ 89; Ex. D-21.) For example, "[i]f there's a lock, they have the key. If there's a password, they know the password." For an insider, "it's not difficult" to substitute ROMs. (Id.)

Insiders "who regularly replace chips because they're authorized to do so" would be able to conduct a switch. (Shamos Test., 3/25 Trial Tr. at 143:11-16.) Furthermore, it is possible they could substitute ROMs even "if they weren't authorized to do so." (Shamos Test., 3/24 Trial Tr. at 119:12-16.) "[T]he guy in the warehouse can do whatever, if he has authorized access to open the machine, then, you know, he could replace the entire innards of the machine if he wanted to." (Shamos Test., 3/23 Trial Tr. at 116:1-7; Shamos Report at ¶ 89; Ex. D-21.) The vote totals could be manipulated by using their own personal computer. (Shamos Test., 3/24 Trial Tr. at 120:5-9.) However, supervisors in multiple counties testified that little security exists in the warehouses and that background checks were rarely, if ever, conducted.

Moreover, the results cartridge can be corrupted by an insider who transports the cartridge. (Shamos Test., 3/24 Trial

Tr. at 165:9-10.) One can "prevent those insiders from doing things with physical interlock." (Id.) Even transporters that do not have authorized access could open these locks, be unobserved, and corrupt the cartridge. (Id.)

Additionally, employees who operate WinEDS and set up ballot programming could "[c]ause great concern about inconsistencies in vote totals" and could cause through the audio daughterboard, cause the DREs to not function on Election Day. (Shamos Test., 3/25 Trial Tr. at 33:25 to 34:1.) All voting machines have a "mechanism by which authorized service personnel can upgrade the firmware in the machine." (Shamos Test., 3/25 Trial Tr. at 27:13-23.) Fraudulent firmware can be "surreptitiously introduced [by insiders] into the devices that the authorized technicians are using." (Id.) Indeed, technicians may not even know they are installing malware into a voting machine. This would be difficult to detect. (Id.)

Appellees have ignored the advice of their expert witness. A very basic and preliminary way to prevent "insider" jobs is through well-designed employee schedules and protocols "[b]ecause co-workers are going to know that you're doing something that is not on the regular schedule." (Shamos Test., 3/23 Trial Tr. at 118:21-25.) At a bare minimum, Dr. Shamos recommends "storing the machines behind locked doors" or "storing them in warehouses where persons unknown would be immediately recognized as

outsiders, or having 24-hour video monitoring in warehouses." (Shamos Test., 3/23 Trial Tr. at 115:15-25.)

4. DREs Can Be Hacked By Third Party Contractors.

New Jersey counties employ non-county employees and third party contractors to perform vital functions on DREs, including testing and updating the voting equipment. Most of the time, this is done with little to no supervision by county employees. Furthermore, no background checks are conducted on those hired to do this very important work. The unfettered access to DREs of third parties and non-county workers fits within Dr. Shamos' definition of an insider.

In Bergen and Hudson Counties, outside vendors are used to transfer the Sequoia Advantage DREs from warehouses to polling locations before elections, and from polling places to warehouses after elections. Those outside vendors are not accompanied by any county employees. There is ample opportunity for these outside contractors to tamper with voting machines. The contractors ride in the back of moving trucks with the DREs. Additionally, there is no transfer of custody papers between the county, the vendor, and the polling locations. The warehouse workers do not communicate with anyone at the polling locations to ensure that the DREs were delivered.

Furthermore, WinEDS software, the AVC Advantage's vote tabulation equipment, is routinely handled by third parties. When the WinEDS software on the Bergen County Sequoia Advantage DREs was upgraded, it was done by an independent outside vendor, Election Graphics, which was hired by Sequoia. Bergen County gave the vendor full, unsupervised access to Bergen County's DREs. (Mahoney Test., 2/23 Trial Tr. at 102:12 to 103:20.) The process of upgrading the software took between three and four weeks. (Mahoney Test., 2/23 Trial Tr. at 103:21-24.)

Similarly, for every election in Bergen County, ballot definitions are uploaded to WinEDS computers by Sequoia, from a jump drive, a month before every election. (Mahoney Test., 2/23 Trial Tr. at 112:2-8.) The jump drive is never checked for corruption or viruses before it is put into the county's laptops. (Mahoney Test., 2/23 Trial Tr. at 114:17 to 115:19.) Neither Mr. Mahoney nor any other Bergen County employee has ever performed any tests to determine if the laptops have become corrupted. (Mahoney Test., 2/23 Trial Tr. at 115:20-23.) The ballot definition is then loaded on to the results cartridges, which are placed in the DREs. (Mahoney Test., 2/23 Trial Tr. at 118:2-5.) When this is happening, the backs of the DREs are open, and the keys are on top of the DREs. (Mahoney Test., 2/23 Trial Tr. at 118:10-22.) Anyone in the warehouse can easily access the insides of the DREs at this time.

Similarly, in Hudson County, pre-LAT testing is not conducted in-house. Election Graphics conducts pre-LAT tests before each election. (Gentile Test., 2/23 Trial Tr. at 48:1-5.) The Division of Elections employees do not directly supervise Election Graphics. (Gentile Test., 2/23 Trial Tr. at 50:13-18.) During the pre-LAT procedure, the back doors of all the DREs are left open. (Gentile Test., 2/23 Trial Tr. at 50:20-23.) The pre-LAT process takes approximately two full days every time there is an election. During this time, the ROM and Z80 chips are accessible to all and can be manipulated.

As discussed above, third-party vendors and non-county employees are regularly hired to handle the Sequoia DREs and equipment. However, neither Ms. Gentile nor Mr. Mahoney could recall or confirm whether those handling DRE equipment had undergone a simple background check. Thus, the Appellees know nothing about who is handling their sensitive and inherently insecure voting equipment. Employing third parties to perform vital election functions unsupervised, combined with the fact that no one undergoes background checks is a serious security breach.

5. New Jersey Has No Protections In Place For Its Voting Machines.

Robert Giles, the Director of the New Jersey Division of Elections, testified that there are no uniform state-wide

procedures or policies for the storage, maintenance, service or transport of Sequoia Advantage DREs from his office. (Giles Test., 3/3 Trial Tr. at 152:21-24, 153:4-16, 155:20 to 156:8, 154:3-11, 158:1-4, 155:3-17, 157:1-8.) Listed below are some key examples:

- There is no uniform state-wide policy concerning how DREs should be stored in county warehouses. (Giles Test., 3/3 Trial Tr. at 152:21-24.)
- There is no statewide policy for how keys for the DREs should be stored in each county. (Giles Test., 3/3 Trial Tr. at 153:4-7.)
- There is no uniform procedure for the pre-LAT examinations (Giles Test., 3/3 Trial Tr. at 154:3-6.) There is also no statewide recommendation for how many test votes should be cast during the pre-LAT examinations. (Giles Test., 3/3 Trial Tr. at 154:3-11.)
- There is no uniform state-wide procedure for transporting the DREs to and from the polling sites. (Giles Test., 3/3 Trial Tr. at 153:8-12.)
- There is no uniform state-wide policy for conducting security checks on the employees of private moving companies who transport the DREs from the warehouses to the polling sites. (Giles Test., 3/3 Trial Tr. at 156:5-8.)
- There is no uniform state-wide policy for the storage of cartridges used by the AVC Advantage DREs. (Giles Test., 3/3 Trial Tr. at 157:1-8.)

- There is no state directive as to how many votes should be cast during a pre-LAT test. (Giles Test., 3/3 Trial Tr. at 158:1-4.)

Appellants' security expert, Dr. Roger Johnston, testified that New Jersey's overall lack of any security culture leaves its DREs exposed to tampering. (See Johnston Test., 4/21 Trial Tr. at 58:5 to 64:3.) He was particularly disturbed by Mr. Giles and his "lack of a systematic approach to security." (Johnston Test., 4/21 Trial Tr. at 60:1-22.) According to Dr. Johnston, the Appellees' DREs are vulnerable in part because "it's clear that there is no plan or uniform policy or strategy for securing the voting machines either during storage, when transporting them, when locking them up, when leaving them in voting locales prior to the election." (Johnston Test., 4/21 Trial Tr. at 67:1-68:25; see also Johnston Expert Report, ¶ 86; Ex. P-81; Pa1082.)

B. DREs Can Be Purchased From The Internet.

The general public is able to obtain DREs, including the Sequoia AVC Advantage, on which to practice stealing an election. Prof. Appel testified that DREs are readily available to any member of the public freely intact on auction sites for very low prices. (Appel Test., 1/27 Trial Tr. at 121:6-17.) Prof. Appel was able to acquire five Sequoia AVC Advantage version 5 DREs on the GovDeals.com auction site, on which federal, state, and local government agencies auction used or surplus equipment to the public. (Id.) He paid a total of only $82 for all of them

($16.40 each). (Appel Report § 11.7, at 42; Ex. P-2; Pa574.) Prof. Appel did not have to show any credentials before purchasing these DREs, nor did he have to reveal his motive for buying the DREs. (Id.)

The DREs Prof. Appel purchased online were similar enough to the AVC Advantage 9.00H that it greatly assisted him in creating his vote stealing program. (Appel Test., 1/27 Trial Tr. at 122:24 to 124.8.) Prof. Appel testified that an upgrade in firmware from an older version of a DRE obtained on the Internet to a newer DRE would not require a hacker to create a vote stealing software from scratch. (Appel Test., 1/28 Trial Tr. at 125:18 to 126:6; Appel Report; § 11.2, at 8, § 11.3 at 39; Ex. P-2; Pa570-71.) The reverse engineering process could be started on an older version of the AVC Advantage firmware and would just need to be finished using information obtained from a DRE that is actually in use. (Id.)

C. Once An Attacker Gains Access To The ROM Chip, The Attacked Can Reverse Engineer It To Create Vote-Stealing Software.

Once an attacker gains access to the motherboard and removes the ROM chip, he or she could acquire the source code from a Sequoia DRE's firmware by reverse engineering the ROM chips. (Appel Test., 1/28 Trial Tr. at 125:18 to 126:6; Appel Report, § 11.2, at 38, § 11.3, at 39; Ex. P-2; Pa570-71.) Appellees' expert, Dr. Shamos, agrees with Prof. Appel that an

undetectable vote-stealing program can be created by someone with ordinary computer training. (Felten Test., 2/10 Trial Tr. at 17:18 to 18:12.)

Reverse engineering is a common practice in computer science, (Appel Test., 1/28 Trial Tr. at 125:18 to 126:6; Appel Report, § 11.2, at 38, § 11.3, at 39; Ex. P-2; Pa570-71) and would work just as well as the original source code would for creating fraudulent firmware. (Appel Test., 1/28 Trial Tr. at 128:2-10.) Reverse engineering the Sequoia DREs firmware requires removing a ROM chip from the DRE. (Appel Test., 1/28 Trial Tr. at 57:6-11.) The legitimate ROM chip could be read with an inexpensive, commonly available ROM reader/programmer which cost only $149. (Appel Test., 1/28 Trial Tr. at 57:6-11.)

Thereafter, the legitimate ROM chip can be returned to the motherboard. The attacker can reverse engineer the source code at his leisure, away from the point of attack. (Shamos Test., 3/23 Trial Tr. at 122:4-7; Shamos Test., 3/24 Trial Tr. at 120:5-9.) Appellees' expert, Dr. Shamos, testified that ROM chips could be reverse engineered from the comforts of home to create vote-stealing programs. (Shamos Test., 3/24 Trial Tr. at 120:5-9.)

Reverse engineering the ROM chip is a straightforward task which can be accomplished in several weeks, (Appel Test., 1/28 Trial Tr. at 126:18-23), with only a moderate level of computer

knowledge. (Id.) Prof. Appel testified that a person with a Bachelor's degree or equivalent experience in computer science, (Appel Test., 1/28 Trial Tr. at 130:10 to 131:5), could reverse engineer a ROM chip to determine its source code. (Appel Test., 1/28 Trial Tr. at 129:16 to 130:5.)

D. WinEDS Is Insecure And Can Be Manipulated To Change Election Results.

1. Vote-Stealing Viruses From The Internet Can Infect Computers Running The WinEDs Election Tabulation Software And Can Propagate Through County Computers And Networks Used For Vote Tabulation.

WinEDS is an "election management system." (Smith Test., 3/18 Trial Tr. at 106:9-13.) Sequoia manufactures and sells WinEDS to work in conjunction with their AVC Advantage DREs. (Sollami-Covello Test., 2/24 Trial Tr. at 62:17-19.) The WinEDS application serves a very prominent role in the election process: (1) before an election, WinEDS is used to prepare ballot definitions for Sequoia's DREs in conjunction with the Results Cartridge and Audio Ballot Cartridge, and (2) after an election, it is used to culminate the results from those same DREs. (Appel Test., 1/27 Trial Tr. at 172:24 to 173:7; 1/28 Trial Tr. at 4:22 to 5:8, 6:9-19, 2/4 Trial Tr. at 19:22 to 20:10.) The application runs on ordinary, commercially available personal computers. (Sollami-Covello Test., 2/24 Trial Tr. at 63:4-7.)

After examining the Union County laptop computer that ran the WinEDS program on Super Tuesday, Prof. Appel concluded that it was "regularly and repeatedly connected to the Internet over a long period of time." (Appel Test., 1/29 Trial Tr. at 65:5-7, 66:9-18, 67:4-9, 69:12-24, 69:11-24; Appel Report, § 23.1 at 66; Ex. P-2; Pa597.) He discovered "thousands" of saved files in the "Temporary Internet Files" folder stored on the Union County laptop. (Appel Test., 1/29 Trial Tr. at 63:15.) Typically, when navigating the Internet with a commercial web browser like Internet Explorer, the browser will place Internet files into a folder stamped with a date. (Appel Test., 1/29 Trial Tr. at 63:15, 63:19-24.) Thus, "Temporary Internet Files" placed into their respective folder create a record or log of Internet activity. (Appel Test., 1/29 Trial Tr. at 63:13-18.)

Prof. Appel examined these files and concluded that Internet Explorer was used numerous times on Union County's WinEDS computer to browse the Internet, download software, and even access a bank account on the day of the 2008 Presidential Primary election. (Appel Test., 1/29 Trial Tr., 65:12-18.) The dates culled from the files spanned a period of years that included "periods immediately before and after the February 2008 election." (Appel Test., 1/29 Trial Tr., 65:12-18.) This includes "the days leading up to and including the primary

election of February 5, 2008." (Appel Test., 1/29 Trial Tr., 63:13-18.)

During this period, Internet files, maintained by Internet Explorer, revealed a "large number of websites visited for mail, shopping, personal banking, streaming music, pictures, and checking news and sports results." (Appel Test., 1/29 Trial Tr., 65:3-7.) The great majority of web browsing had little to do with Union County as only a small amount were related to Union County's official website, UCNJ.org. (Appel Test., 1/29 Trial Tr., 65:7-9.)

Prof. Appel testified that each of the visits to these websites made the laptop computer susceptible to the ill effects of malware and malicious software. (Appel Test., 1/29 Trial Tr., 65:22-24, 66:1-8.) Malicious websites can exploit vulnerabilities in the operating system and have the potential to "insert viruses into the personal computer that's used to visit those websites." (Appel Test., 1/29 Trial Tr., 65:22-24, 66:1-8.) Furthermore, accessing the Internet allows a scenario where "outsiders can interfere with preparation of the ballots, can modify the results as they are added up, and change the data stored in the database." (Appel Report § 23.1 at 66; Ex. P-2; Pa597.) Therefore, as a rule, security-sensitive computers should not be used for casual web browsing. (Appel Report § 23.4 at 66; Ex. P-2; Pa597.)

Casual web browsing is highly problematic because "untrustworthy web sites can cause spy ware and viruses to be downloaded onto the computer." (Appel Report § 23.1 at 66; Ex. P-2; Pa597.) "Each visit" to a website typically triggers "a host of downloaded images and tracking information from advertising sites, like Double Click, Dakota, [sic] Advertising.com." (Appel Test., 1/29 Trial Tr., 65:9-12.) Thus, by accessing the Internet, users unknowingly leave the computer "severely vulnerable" to malicious software. (Appel Report § 23.4 at 66; Ex. P-2; Pa597.)

The consequence of viral propagation via WinEDS can steal votes in multiple ways. First, before an election, a virus could "cause WinEDS to write fraudulent ballot definitions into (large-format) results cartridges." (Appel Report § 22.9, at 65.) Fraudulent ballot definitions could be designed that would miscount votes, such as by counting two votes for a candidate with a single button press from a voter. (Appel Report, § 43.1, at 94-95; Pa625-26.) After an election, a virus could "cause WinEDS to fraudulently miscount votes, when it accumulates the results from different precincts," casting the results of the election into doubt if they differed from the results on the results report printouts. (Appel Report § 22.9, at 65.)

Secondly, viral propagation could reach the daughterboard of the AVC advantage via the Audio Ballot Cartridge or through a

corrupted network connected to the Internet. Fraudulent firmware installed on the daughterboard can steal votes and disenfranchise voters in a number of ways. The most significant way is that it can change the votes of those voters who vote by audio, that is, blind voters or any voters who request to vote using the audio kit. (Appel Test., 1/29 Trial Tr. at 74:8-16.) The fraudulent firmware can change those votes before they are sent to the motherboard for tabulation. (Id.) Thus, disabled voters are more at risk from vote-stealing fraudulent firmware in the audio kit. (Appel Test., 1/28 Trial Tr. at § 24.4, at 69.7)

In addition to the threat to disabled voters, the vulnerability of the daughterboard to attacks can also impact the votes of non-disabled voters. (Appel Report, § 24.5, at 69-70; Ex. P-2; Pa600-01.) Viral infection of the daughterboard can disable the motherboard when the computer is first turned on, thereby selectively disabling DREs in precincts selected by the attacker. (Appel Report, § 24.2, at 69; Ex. P-2; Pa600.) The means the daughterboard uses to disable the motherboard is called a “buffer overrun” attack which disables the machine. An attacker might disable voting machines in selected precincts because they include a preponderance of voters of the party the attacker wants to lose. (Appel Test., 2/4 Trial Tr. at 21:12-22; Appel Report, § 24.5, at 69-70; Ex. P-2; Pa600-01.) As Sequoia DREs fail,

long lines would form, delaying voters from casting their votes. (Id.)

a. AmpX Was Downloaded From The Internet Causing Severe Vulnerabilities.

In addition to general web browsing, Prof. Appel found America Online AmpX Music Streaming Service installed on the Union County laptop computer. (Appel Test., 1/29 Trial Tr. at 67:7-9.) This service allows someone to listen to online music. (Appel Test., 1/29 Trial Tr. at 67:7-9.) A computer security company, Symantec, has described AmpX as having a "high" severity vulnerability. (Appel Report § 23.5 at 67; Ex. P-2; Pa598.) An attacker exploiting the AmpX security vulnerability would produce a malicious music stream. (Id.) The stream would then install a virus on the WinEDS computer. (Id.) The attacker would have access to the WinEDS computer and would be able to modify the WinEDS vote database or the WinEDS vote-counting program. (Id.) The AmpX service was "regularly" used on the Union County laptop computer allowing Internet hackers to take over the Union County's WinEDS computer. (Appel Test., 1/29 Trial Tr. at 67:4-7.) Thus, the possibility exists for an "attacker anywhere on the Internet" to interfere and subvert the main functions of WinEDS." (Appel Test., 1/29 Trial Tr. at 69:15-24.)

b. WinEDS Computers Can Be Connected To The Internet.

The WinEDS laptop computer examined by Prof. Appel was equipped with the Microsoft Windows XP operating system and standard software such as Internet Explorer 7.0, Microsoft Office, and Windows Media Player. (Appel Test., 1/27 Trial Tr. at 176:20, Appel Report § 22.2-3 at 63-64; Ex. P-2; Pa595-596.) Notably, Microsoft Windows and Internet Explorer contain security vulnerabilities continually discovered in the operating system on a month-to-month basis. (Appel Test., 1/29 Trial Tr at 65:22-25, 66:1-3, Appel Report § 23.3 at 66; Ex. P-2; Pa597.)

Although Microsoft tries to "patch" these vulnerabilities, users of the operating system should expect vulnerabilities at "any given time." (Appel Test., 1/29 Trial Tr. at 65:22-25, 66:1-3.) These vulnerabilities expose the computer, the WinEDS election management program, and its data to an Internet attack. (Appel Report § 23.1 at 66; Ex. P-2; Pa597.) Thus, Sequoia's voting machines are heavily reliant on Microsoft Corporation because Sequoia has little control over Windows or other Microsoft applications. (Shamos Test., 3/23 Trial Tr. at 165:15-17.) Consequently, WinEDS computers are susceptible to all Internet attacks successfully used "every day" to infiltrate ordinary Windows computers. (Appel Report § 28.2 at 74; Ex. P-2;

Pa605.) This includes Internet viruses, websites containing spyware, port scanning, and e-mail phishing. (Id.)

Microsoft Windows communicates "with the outside world" with a large variety of "services" and "protocols" that are employed to connect with the Internet. (Appel Report § 23.6 at 67; Ex. P-2; Pa598.) Each of these services and protocols are communicative devices that "constitute a vector" in which attackers anywhere on the Internet can insert malicious software onto a computer used to browse the Internet. (Appel Report § 23.6 at 67; Ex. P-2; Pa598.) Therefore, in order to preserve the integrity of computers handling information requiring protection, the services of the computer's operating system should be configured to "minimize the number of attack vectors." (Appel Report § 23.7 at 67; Ex. P-2; Pa598.)

"One common vector that Internet scammers use to infect PCs with malware is by e-mail attacks." (Appel Report § 23.8 at 67; Ex. P-2; Pa598.) Opening a "bogus email attachment" can cause a malicious attack. (Id.) Thus, computers used to access email and to employ WinEDS causes a large security concern. (Id.)

Prof. Appel found that the Union County laptop did not minimize these vectors because it had a large number of services automatically enabled. (Appel Report § 23.7 at 67; Ex. P-2; Pa598.) These services include SQL Server, Universal Plug and Play, Net Logon, and Remote Registry. (Id.) Additionally, the

Window firewall was disabled, but a port scan of the machine revealed several open Transmission Control Protocol (TCP) ports and a dozen User Datagram Protocol (UDP) ports. (Id.) All of these programs and open ports constitute potential vectors that can be opportunities to attack Windows or WinEDS. (Id.)

These security vulnerabilities are highly problematic because the WinEDS application itself is insecure. (Appel Report § 27.1 at 72; Ex. P-2; Pa603.)

Testimony by election officials from Union, Mercer, Hudson, Ocean and Bergen Counties reveals that WinEDS computers have Internet access and were used to connect to the Internet. Moreover, Mr. Giles, the Director of the New Jersey Division of Elections, admitted that his office had never issued a directive prohibiting laptops or computers used to transmit election information from being connected to the Internet." (Giles 3/3 110:23-24, 157:17-25.)

c. Any Computer Connected To Both The Internet And Internal Network Can Corrupt The Whole Network.

If any computer on a network is connected to the Internet, a viral infection can propagate to a WinEDS computer also sitting on that network. Networks with Internet access allow viral propagation because "[a] computer virus is a program that can copy itself from one computer to another, either through computer networks or through removable media such as cartridges." (Appel

Report § 20.2 at 59; Ex. P-2; Pa591.) This can compromise the "the integrity of the ballot preparation process and the integrity of the election tabulation process are compromised." (Appel Test. 1/29 Trial Tr. at 70:15-17.)

Any one computer connected to the Internet on that network can facilitate viral propagation over the county's entire network. (Appel Test., 1/29 Trial Tr. at 70:4-10.) Accordingly, if a WinEDS computer connected to the network can succumb to viral infection without itself actually being connected to the Internet. (Appel Test., 1/29 Trial Tr. at 70:4-10.) "If that network is connected to the Internet, then the infection from the Internet of even one machine on that network can propagate to all of the other WinEDS machines in that county's network." (Appel Test., 1/29 Trial Tr. at 70:7-10.)

Viral propagation works both ways as well. If a virus resides on a WinEDS computer and that computer is connected to a network, the virus "can copy itself onto other WinEDS computers on the same network." (Appel Report § 20.6 at 60; Ex. P-2; Pa592.) Having any WinEDS computer accessing the Internet allows for an Internet virus to propagate through "through County or State internal networks, to other WinEDS computers." (Appel Report § 22.9.)

d. Should Any WinEDS Computers Become Corrupted, The Integrity Of The Results Cartridge Becomes Suspect.

Once a virus propagates onto the WinEDS computer, the virus can adversely affect data residing on the Results Cartridge. (Id.) A virus could "cause WinEDS to write fraudulent ballot definitions into (large-format) Results Cartridges." (Id.) Furthermore, a virus could "cause WinEDS to fraudulently miscount votes, when it accumulates the results from different precincts." (Id.) In other words, "malicious software can change ballot definitions (before elections) and change vote data (after elections)." (Appel Report § 23.17 at 69; Ex. P-2; Pa600.)

The Results Cartridge is an integral piece of the DRE's setup and is the primary vehicle to transmit information from WinEDS, a database coordinating all election data, to the AVC advantage and vice versa. The Results Cartridge has two broad responsibilities in the election: (1) the "cartridge is used to convey the ballot definition to the voting machine before the election" and (2) the cartridge is used to "convey the results back to the WinEDS after the election." (Appel Test., 1/28 Trial Tr. at 6:14-19.) The cartridge is about the size of a VHS tape and typically has 96 kilobytes of storage capacity. (Appel Test., 1/28 Trial Tr. at 6:23-25, Appel Report § 2.5 at 12; Ex. P-2; Pa544.) Each cartridge is reusable and there is no protection against reading and writing data in the cartridge and

a corrupted WinEDS computer can change election data. (Appel Report § 40.2 at 90; Ex. P-2; Pa621.)

The WinEDS application is used to coordinate all of the DREs via the many Results Cartridges. Accordingly, the portable Results Cartridge must transmit and receive data and instructions from the WinEDS computer. (Appel Test., 1/27 Trial Tr. at 177:3-12.) To do so, the Results Cartridge is linked to a WinEDS computer via a "cartridge reader writer." (Appel Test., 1/27 Trial Tr. at 177:3-12.) The "cartridge reader writer" connects to the WinEDS computer by connecting a USB cable drawn from the reader writer to the computer's USB port. (Appel Test., 1/27 Trial Tr. at 177:3-12.) The "cartridge reader writer" has the ability to read election data as well as write data onto a Results Cartridge when attached to a WinEDS computer. (Appel Test., 1/27 Trial Tr. at 177:3-12.) Thus, if the WinEDS computer is corrupted, the information on the Results Cartridge can be corrupted before and after an election.

Before an election begins, election workers use WinEDS to write ballot definitions into Results Cartridges. A ballot definition informs the AVC Advantage of the candidate's names and the names of the contests. (Appel Test., 1/27 Trial Tr. at 173:3-7.) Additionally, the ballot definition informs the DRE of which candidates are running in which contests by coordinating "the buttons on the full face ballot" to correspond with the

respective candidates. (Appel Test., 1/27 Trial Tr. at 173:3-7.)

In order to write the ballot definition, the Results Cartridge is placed into the "reader writer" that is linked to the WinEDS computer and WinEDS runs tests, "clears what's there previously[,..] checks its [b]attery[,] and the read writability." (Clayton Test., 2/26 Trial Tr. at 195:1-7.) Then WinEDS programs the Results Cartridge for a particular DRE, by writing the ballot definition into the Results Cartridge and prepared data "about the layout of the ballot" is copied onto the Results Cartridge for each voting machine. (Appel Test., 1/27 Trial Tr. at 179:3-6.) Should any incorrect information find its way onto the DRE via the Results Cartridge, the DRE's record of votes cast would not correspond with the voter's intent.

After the election and after the polls close, the AVC Advantage communicates vote totals to election officials by first, printing a paper Results Report printout and secondly, writing the totals and a ballot images onto the Results Cartridge. (Appel Report § 2.5 at 12; Ex. P-2; Pa544.) Stored on the motherboard of the AVC Advantage is another copy of the ballot images. (Appel Test., 1/28 Trial Tr. at 112:8-9.) Again, in order to read the ballot images and the vote totals, the Results Cartridge is connected to a WinEDS computer via the "reader

writer." (Appel Report § 2.5 at 12; Ex. P-2; Pa544.) After the Results Cartridge is inserted, the WinEDS software "extract[s] the election results and cumulate[s] the results from all the precincts." (Appel Report § 20.5 at 60; Ex. P-2; Pa592.) Thus, if a computer is connected to the Internet and infects WinEDS, the vote data on the Results Cartridge can be infected or lost because WinEDS has the ability to read and write onto the Results Cartridge.

e. Viral Propagation Can Infect The Daughterboard Of The AVC Advantage.

There are three ways that an infected WinEDS computer can corrupt the daughterboard of the Sequoia AVC Advantage DRE: (1) a virus can propagate from the audio ballot cartridge to WinEDS, (2) a virus can propagate from WinEDS to the audio ballot cartridge, and (3) a virus can propagate from WinEDS to other WinEDS computers on the same network. (Appel Test., 1/29 Trial Tr. at 3:2-12, 3:8-9, 3:9-10, and 3:11-12; Appel Report, §§ 19-22 at 56-65, § 24 at 69-70, and § 26 at 71-72; Ex. P-2; Pa588-96, 600-01, 602-03.) Viral infection of the daughterboard can disable the motherboard when the computer is first turned on, thereby selectively disabling DREs in precincts selected by the attacker. (Appel Test., 1/29 Trial Tr. at 74:17-23; Appel Report, § 24.5, at 69-70; Ex. P-2; Pa600-01.)

A virus already affecting or resting on a WinEDS computer can infect the audio ballot cartridge when connected to the computer. An audio ballot cartridge connects to a personal computer through a standard Personal Computer Memory Card International Association ("PCMCIA") port on the laptop computer by using a standard PCMCIA extender card. (Appel Report § 22.4 at 64; Ex. P-2, Pa596; Appel Test., 1129 Sealed Trial Tr. at 10:17-22; Ex. P-11, Pa736.) Should the WinEDS computer be infected or become infected by an audio ballot cartridge, every audio ballot cartridge it comes into contact can be infected and be used, even unknowingly, to infect its companion DRE. (Appel Report § 22.9.)

Fraudulent firmware installed on the daughterboard can steal votes and disenfranchise voters in a number of ways. (Appel Test., 1/29 Trial Tr. at 74:8-16; Appel Test., 1/28 Trial Tr. at § 24.4, at 69; Ex. P-2; Pa600; Appel Test., 2/4 Trial Tr. at 21:12-22; Appel Report, § 24.5, at 69-70; Ex. P-2; Pa600-601.) The most significant way is that it can change the votes of those voters who vote by audio, that is, blind voters or any voters who request to vote using the audio kit. (Appel Test., 1/29 Trial Tr. at 74:8-16.)

The fraudulent firmware can change those votes before they are sent to the motherboard for tabulation. Thus, vote-stealing

fraudulent firmware in the audio kit can severely effect the votes of the disabled. (Id.)

Furthermore, the general voting public can be affected if the audio ballot cartridge disables the motherboard of the DRE with a "buffer overrun" attack. A "buffer overrun" occurs when a user or a program returns invalid input in response to a request by a computer program, generally a longer string of data than the requesting program wants. The effects of the buffer overruns happen when the DRE is powered on. Its motherboard will request input from the daughterboard, which will then send a malicious message, causing it to reboot. (Id.) This cycle will repeat indefinitely and completely disable the DRE. (Id.) An attacker could disable machines in specific areas that have a preponderance of voters the attacker wants to lose.

f. Appellees' Witnesses Agree With Prof. Appel That Any Connection To The Internet Raises Serious Security Concerns.

Appellees' expert witnesses agree that availability and use of the Internet on a WinEDS computer raises security concerns regardless of whether the computer has actually been hacked. (Shamos Test., 3/23 Trial Tr. at 154:6-12, 13-15.) The Court recognized this when she stated, "We've got a lot of witnesses who testified to [the Internet connection being problematic]. There's nobody who says [the Advantage] should be [connected],

and I'll stipulate to that." (Fleming Test., 4/1 Trial Tr. at 46:17-25.)

Dr. Shamos testified that computers connected once to the Internet or computers with a permanent connection are "a bad and terrible thing." (Shamos Test., 3/23 Trial Tr. at 153:22-25, 154:1-3.) Furthermore, Dr. Shamos testified that a WinEDS computer used to browse the Internet is "never permitted] in the states where [he does voting machine] certifications." (Shamos Test., 3/23 Trial Tr. at 154:1-2.) In his report, he states, "I agree that voting machines and computers on which election management software is installed should never in their lives be connected to the Internet." (Shamos Report 105; Ex. D-21.) Speaking about WinEDS, he stated, "from day one when it's delivered until it dies, you never connect it to the Internet." (Shamos Test., 3/23 Trial Tr. at 154:16-17, 159:16-17.) If the computer is connected at any time during its life and "not just, let's disconnect it now and then run the election," the computer can "pick up" a virus during if one connects to the Internet. (Shamos Test., 3/23 Trial Tr. at 154:13-19.) "Anybody who is connected to the Internet can pick up viruses." (Shamos Test. 3/23 Trial Tr. at 154:20-21.)

Dr. Shamos also recognized the security vulnerabilities of email. Email allows for a network and its computers to be

susceptible to outside manipulation. (Shamos Test., 3/23 Trial Tr. at 157:10-20.)

Sequoia's Edwin Smith also agrees with Prof. Appel that "connection of WinEDS computers to the Internet constitutes a significant security threat." (Smith Test., 3/19 Trial Tr. at 32:19-22.) He testified that "election-related computers never be attached to the Internet but instead be kept on an isolated network." (Smith Test., 3/18 Trial Tr. at 118:5-8.) In fact, he claims, "[t]he first thing you do is never hook them up to the Internet." (Smith Test., 3/19 Trial Tr. at 110:20-21.) This is because when "connecting a voting system to the Internet,... the integrity of the system can be compromised." (Smith Test., 3/19 Trial Tr. at 85:4-7.) After becoming aware that Union County's computer was connected to the Internet, Smith recommended that Union County "should be sanctioned for [allowing] that." (Smith Test., 3/19 Trial Tr. at 111:4-6.) Given Mr. Smith's acknowledgement that Internet connections pose serious security threats, it is irresponsible that Sequoia continues to manufacture and sell voting systems with Internet connectivity. Moreover, it is also irresponsible that Sequoia never discussed these Internet-related insecurities when it presented the WinEDS system to the voting machine Certification Committee in 2006. (See Ex. P-50; Pa858.)

Although in her March 8, 2010 Order, the trial court ordered that all voting systems be disconnected from the Internet, no system was put in place for checking compliance with that order. Given that the WinEDS systems is still capable of being connected to the Internet, there is no way to ensure that an election official (either inadventently or purposely) does not actually connect the WinEDS system to the Internet. Thus, the State's WinEDS system and DREs remain vulnerable to attack.

IV. THE LACK OF STATE OVERSIGHT OF ELECTIONS OR STATE-WIDE PROCEDURES FOR POLL WORKERS MAKES MANIPULATING ELECTION RESULTS EASY.

A. New Jersey Does Not Have Uniform Procedures For Running Elections.

The State's lax election-related procedures allow insiders to manipulate election results. Indeed, Dr. Shamos, the Appellees' expert witness, testified unequivocally that in his opinion insiders pose the greatest threat to election security. (Shamos Test., 3/24 Trial Tr. at 114:21 to 115:4, 116:1-3, 116:1-14, 117:24 to 118:2; Shamos Report ¶ 89 ("[i]t is of course important to institute procedures to ensure that [] insiders cannot mount the attacks proposed, or to ensure that any intrusion will be detected.")). Robert Giles testified that there are no State-wide election-related procedures for handling printed results reports and results cartridges after elections.

(Giles Test., 3/3 Trial Tr. at 157:1-8 and 10-13.) He also testified that throughout the State results cartridges are used to tabulate official election results. (Giles Test., 3/3 Trial Tr. at 161:6-9.) This lack of standardized policy in handling election results leaves the results vulnerable to attack.

1. Paper Results Reports Printed At The Close Of Polls Are The Superior Form Of Vote Tabulation.

When poll workers close the polls, a printer in the back of the Sequoia 9.00H DRE "automatically starts printing out a paper results report." (Appel Test., 1/27 Trial Tr. at 203:17 to 204:20,167:14-24,170:18-22,171:12-14,171:24 to 172:3; Appel Report, § 2.5; Pa544.) The result reports are made by DREs (Pl. Ex. 25; Pa764) "immediately when the polls close, in the presence of witnesses, [and are] signed by those witnesses[.]" (Appel Test., 1/28 Trial Tr. at 112:16-18; Appel Test., 2/4 Trial Tr. at 28:22 to 29:12,52:2-19; Appel Report, § 41.2; Pa623-24.) The paper results report printouts come from the vote totals in the internal memory of the DRE. (Id.)

Prof. Appel demonstrated on the video shown in Court, (Pl Ex. 6; Pa731), how election results are printed on paper results reports, including where the results report shows that votes cast for Bill Richardson were attributed without detection to Dennis Kucinich by Prof. Appel's fraudulent software. (See Appel Test., 1/28 Trial Tr. at 108:6-21; Ex. P-21; Pa750.) There is space on

the paper printout for "poll workers to sign on the lines that they witnessed that this is the paper that came out of th[e] machine." (Appel Test., 1/27 Trial Tr. at 204: 15-18; Appel Test., 2/9 Trial Tr. at 110:5-9.)

While votes are being recorded, the results report printer is inactive. (Appel Test., 1/27 Trial Tr. at 171:12-22.) Results reports contain information about the polling place, and are "supposed to be a record of how many votes have ever been cast on [the] machine[.]" (Appel Test., 1/27 Trial Tr. at 203:25-204:6.) The results report should also "print the public counter, which is how many voters have used th[e] machine in this election[|." (Appel Test., 1/27 Trial Tr. at 204:11-13.)

Even though the paper results reports printed when the polls close may reflect data manipulated by fraudulent firmware installed on a DRE, (Appel Test., 2/4 Trial Tr. at 26:7-20, 52:2-19; Appel Test., 1/28 Trial Tr. at 43:14-24; Appel Report, § 41.1-2; Pa623-24.), election results recorded on results cartridges can be manipulated much more easily. Due to this risk, results reports are superior to results cartridges as a source of election data. (Appel Test., 2/5 Trial Tr. at 56:22-24). Dr. Shamos testified similarly, noting it is safer to rely on signed, authenticated results reports as the official election results. (Shamos Test., 3/24 Trial Tr. at 130:11-131:7.)

B. It Is Easy For A Dishonest Poll Worker Or Election Staffer To Print Fraudulent Results Reports From Results Cartridges.

A results cartridge is a data cartridge about the size of a VHS tape. (Sollami-Covello Test., 2/24 Trial Tr. at 62:10.) Results cartridges are inserted into each DRE prior to an election, (Appel Test., 1/28 Trial Tr. at 6:14-19), and then inserted into cartridge readers on election night to tabulate votes. (Sollami-Covello Test., 2/24 Trial Tr. at 61:12-13.)

The first vulnerability associated with results cartridges is that a dishonest poll worker can reinsert a fraudulently doctored results cartridge into the voting machine to print phony results reports. (Appel Report, § 42.2 to 42.3; Pa625.) Other poll workers may not notice if a dishonest poll worker switched a legitimate results report for a phony results report. (Appel Report, § 42.2 to 42.3, § 42.5; Pa625; Appel Test., 1/27 Trial Tr. at 205:11-18, 206:8-23; Appel Test., 1/29 Trial Tr. at 100:16 to 101:25; Appel Test., 2/4 Trial Tr. at 26:2-20, 105:12 to 106:5, and 107:23 to 108:7.)

Indeed, in Middlesex County the poll worker manual "explicitly recommends that poll workers perform other tasks at the very time the results report is printing[.]" (Appel Report, § 42.5; Pa625.) Additionally, Prof. Appel testified to seeing Mercer County poll workers' casual treatment of results cartridges while they finish the paperwork required for closing

the polls. (Appel Test., 1/27 Trial Tr. at 205:11-18, 206:8-23; Appel Test., 1/29 Trial Tr. at 100:16 to 101:25; Appel Test., 2/4 Trial Tr. at 26:2-20, 105:12 to 106:5, and 107:23 to 108:7.)

Appellants did not have access to other poll worker manuals, as Appellees did not produce them in discovery. Thus, Appellants could not demonstrate that the lax Middlesex and Mercer County practices are common. (See Appel Test., Trial Tr. at 1/27, 101:11-25, 156:9-15.) But, there is evidence those casual practices may indeed be prevalent. Robert Giles testified that there is no uniform, statewide procedure for protecting, handling, storing, or transporting results cartridges. (Giles Test., 3/3 Trial Tr. at 157:10-13.)

As such, while other poll workers are distracted, a dishonest poll worker can insert a phony results cartridge to produce a fake results report only minutes after the polls close. (Appel Report, § 42.2 to 42.3, § 42.5; Pa625; Appel Test., 1/27 Trial Tr. at 205:11-18, 206:8-23; Appel Test., 1/29 Trial Tr. at 100:16 to 101:25; Appel Test., 2/4 Trial Tr. at 26:2-20, 105:12 to 106:5, and 107:23 to 108:7.)

C. Counties Rely On Results Cartridges For Official Election Results, And Do Not Use The Printed Results Report That Is Signed By Witnesses When The Polls Close.

Robert Giles, the Director of the Division of Elections, testified that “throughout the State of New Jersey results

cartridges are used to determine the vote totals at the end of each election." (Giles Test., 3/3 Trial Tr. at 161:6-9.)

This is confirmed by the testimony of both Joanne Rajoppi of Union County, (Rajoppi Test., 2/26 Trial Tr. at 40:24-25, 41:1-10, 45:6-7, 50:8-11, 51:1-3, 51:8-12, 52: 2-8, 52:13-16, 63:10-14, 66:23-25), and Paula Sollami-Covello of Mercer County. (Sollami-Covello Test., 2/24 Trial Tr. at 61:12-13, 61:21-25, 62:1-3, 62:10-14, 65:2-5.) County clerks use results cartridges to determine vote totals even though paper results reports are superior to results cartridges. (Appel Test., 2/4 Trial Tr. at 26:7-20, 52:2-19; Appel Test., 1/28 Trial Tr. at 43:14-24; Appel Report, § 41.1-2; Pa623-24; Giles Test., 3/3 Trial Tr. at 161:6-9; see also Appel Test., 1/28 Trial Tr. at 5:13-24; Appel Report, § 41.4, at 93; Pa624.)

After the election, results cartridges transmit election results to WinEDS computers at municipal or county locations. (Appel Test., 1/27 Trial Tr. at 205:11-18, 206:8-23; Appel Test., 1/29 Trial Tr. at 100:16 to 101:25; Appel Test., 2/4 Trial Tr. at 26:2-20, 55:17 to 56:18, 105:12 to 106:5, and 107:23 to 108:7; Appel Report, § 40.1-40.2, § 40.8; Pa621, 623.) WinEDs is the computer software that converts data on results cartridges into summary reports, which are printable. (Appel Test., 1/27 Trial Tr. at 144:5-15; Appel Test., 1/28 Trial Tr. at 6:9-12, 13:9-18, 121:2-6; DVD 1, 18:47; Pa728; Appel Test.,

4/14 Sealed Trial Tr. at 35:1-4, 35:6-14, 37:22 to 38:2; Rajoppi Test., 2126 Trial Tr. at 42:1-7, 61:20-21; Appel Report, § 27.2, at 72; Pa603.) The summary results can be communicated within counties by email over the Internet. (Rajoppi Test., 2/26 Trial Tr. at 41:1-19, 45:6-7, 47:9 to 48:5, 48:18-25, 49:10-11, 49:19-20, 51:8-12; Giles Test., 3/3 Trial Tr. at 157:17-25.)

Election results are then posted to county websites within an hour or two on election night based on tabulation results gleaned from results cartridges that are used to electronically tabulate vote totals. (Appel Test., 1/27 Trial Tr. at 172:24 to 173:7, 211:21-25; Appel Test., 1/28 Trial Tr. at 4:22 to 5:8, 6:9-19; Appel Test., 2/4 Trial Tr. at 19:22 to 20:10; Sollami-Covello Test., 2/24 Trial Tr. at 65:2-5; Rajoppi Test., 2/26 Trial Tr. at 41:1-19, 42:1-21, 43:3-16, 43:20-24; 45:6-7, 47:9 to 48:5, 48:18-25, 49:10-11, 49:19-20, 50:8-11; 51:1-22; 52:2-8.) County clerks thereafter certify the election. (Sollami-Covello Test., 2/24 Trial Tr. at 61:5-7, 64:9-11, 65:20-24, 66:1-3; Rajoppi Test., 2/26 Trial Tr. at 40:24-25, 41:4-10. Rajoppi Test., 2/26 Trial Tr. at 51:16-23, 52:13-16, 63:10-14, 66:23-25.)

The testimony of Robert Giles and several county election officials directly contradicts the testimony and report of Dr. Shamos, the State's expert witness. Dr. Shamos asserts that "the 'use' of electronic totals by county clerks is for unofficial

purposes on only[.]" (Shamos Report, ¶ 144; Shamos Test., 3/25 Trial Tr. at 33:3-17.) Many witnesses testified that this is not the case in New Jersey. Additionally, Dr. Shamos is incorrect that it is a "common misconception" that "the tabulation function performed by WinEDS on election night can determine the outcome of the election." (Shamos Report, ¶ 104, ¶ 143.) The State and county officials' testimony cited above makes clear that the results cartridges and not the results tapes determine the official election results.[8]

This was demonstrated clearly in 2008 in Camden County, where the County Clerk used the data from the [results] cartridge in tabulating the election, even though this data disagreed with the data on the paper tape printout, and even though election technicians in Camden County had already logged information that could [be] easily interpreted to mean the cartridge might not reliably contain the votes. (Appel Report, § 30.4, at 79, § 41.5, § 57.14-57.17, Fig. 36, § 57.4; Pa610; 624, 656-57; 658, 653; Appel Test., 1/28 Trial Tr. at 5:20-24; Appel Test., 2/4 Trial Tr. at 52:20 to 53:18.)

[8] The results are "unofficial" because they have not been added to absentee and provisional results, and the election has not been certified, (FOF 579, 581, 614, 621-624), not because the results tape is used as the official results in the election.

D. The State Relies On Results Cartridges For Election Results Even Though There Are Many Opportunities To Manipulate Results Cartridges.

Robert Giles testified that there is no uniform, statewide policy or procedure governing poll worker treatment of voting machines or their components. (Giles Test., 3/3 Trial Tr. at 152:21-24, 153:8-16, 155:24 to 156:8, 157:1-8.) Mr. Giles also testified that "there [is] no uniform statewide procedure for transporting the cartridges from the polling sites to various county clerk's offices." (Giles Test., 3/3 Trial Tr. at 157:10-13.) Further, Mr. Giles admits the policies for transporting results cartridges differ from county to county. (Giles Test., 3/3 Trial Tr. at 157:10-13, 157:14-16.)

Results cartridges are very vulnerable to tampering and are easy to physically and electronically manipulate even while they store election data. (Appel Test., 1/29 Trial Tr. at 101:7-9, 103:21 to 104:3; Appel Report, § 40.6; Pa622.) Neither hardware nor cryptography protects the data in the cartridge. (Appel Test., 2/4 Trial Tr. at 56:18 to 57:19; Appel Report, § 39.2, at 88; § 39.6, at 89; Pa619-620; Shamos Test., 3/24 Trial Tr., 128:15-129:5.) When results cartridges are removed from DREs, they are immediately susceptible to manipulation. (Appel Test., 2/4 Trial Tr. at 55:17 to 56:18; Appel Report, § 40.1-40.2, § 40.8; Pa621, 623.) (emphasis in original). Because there is no uniform, statewide policy protecting the transportation of

results reports and results cartridges, (Giles Test., 3/3 Trial Tr. at 152:21-24, 153:8-16, 155:24 to 156:8, 157:1-8), dishonest poll workers or election officials have ample opportunities to write fraudulent data to results cartridges. (Appel Test., 1/29 Trial Tr. at 101:7-9, 103:21 to 104:3; Appel Report, § 40.6; Pa622.)

A dishonest poll worker could use a simple program run from a personal computer to change votes on both the candidate total files and ballot image files. (Appel Test., 1/29 Trial Tr. at 96:18 to 97:2,99:16-24; 101:7-9, 103:21 to 104:3; Appel Report, § 40.1-40.2, § 40.4, § 40.6, § 40.8; Pa621-23; Appel Test., 2/4 Trial Tr. at 55:17 to 56:18; see also Shamos Test., 3/24 Trial Tr.at 128:15-129:5.) Prof. Appel's expert report also explains the ease of fitting a vote-stealing computer program onto a very small computer. This computer is smaller than a pack of cigarettes. (Appel Test., 1/29 Trial Tr. at 96:18 to 97:2, 99:16-24; Appel Report, §40.4-40.5, at Fig. 27-28; Pa621-22.) and can then be plugged into a results cartridge to quickly and surreptitiously change vote totals. (Appel Test., 1/29 Trial Tr. at 96:18 to 97:2,99:16-24, 101:7-9; 103:21 to 104:3; Appel Report, § 40.4, § 40.5, §40.6; Pa621-22.)

E. Results Cartridges Can Easily Be Acquired And Be Converted, Falsified, Or Altered To Manipulate Election Results.

Legitimate results cartridges can be altered to modify election results. Prof. Appel reported that there are several simple, inexpensive ways results cartridges can be physically or mechanically altered to change election results. For example, official results cartridges can be physically altered to act differently.[9] (Appel Report, §§ 44-46; Pa627-30), include readable and writeable memory (Appel Report, § 47; Pa630-32), or steal votes. (Appel Report, § 48; Pa632-33.) It is not difficult to acquire results cartridges and make these alterations. As Prof. Appel testified, he bought five Sequoia Advantage DREs and five result cartridges on the Internet for $82. (Appel Test., 1/27 Trial Tr. at 121:6-17; Appel Report, § 11.6-11.7; Pa571-74.)

[9] The list of vulnerabilities discussed here is not exclusive. Prof. Appel explained that other data cartridges which "have the same size, shape, and appearance" (Appel Report, § 44.1-44.2; Pa96), as results cartridges, and can easily be rewired (Appel Report, § 44.2, § 46.3; Pa627-Pa629) to fraudulently steal votes at the polling place. (Appel Report, § 46.3; 4.15, Fig. 5; § 46.4, n.89, § 40.4-40.5, at Fig. 27-28; Pa629; Pa551; Pa629; Pa621-22.) Further, Prof. Appel explained in his expert report that New Jersey should not use early voting cartridges on AVC Advantage DREs. (Appel Report, § 45; Pa628.) Further, the risk presented by consolidation cartridges, for example, is "very dangerous" because the pre-election vote doctoring can easily go undetected.

Additionally, election workers and outside vendors can steal cartridges from the counties. Mr. Giles testified that there is no uniform, statewide policy regarding how results cartridges are stored by counties. (Giles Test., 3/3 Trial Tr. at 157:1-8.) They are not secured in any meaningful way. Elisa Gentile testified that in Hudson County all five-hundred cartridges are stored "in the open" on a wheeled casing. (Gentile Test., 2/23 Trial Tr., at 54:16-25, 55:23-13.) Additionally, after results cartridges are loaded into DREs at the warehouse, (Gentile Test., 2/23 Trial Tr. at 47:17-25, 48:1-3, 50:25-51:19, 75:1-4), a vendor may access hundreds of DREs over several days without county supervision. (Gentile Test., 2/23 Trial Tr. at 50:20-23, 47:17-25, 48:1-50:18, 50:25-51:19, 75:1-4.)

Similarly, Daryl Mahoney testified that Bergen County's results cartridges are stored in lockable cabinets in a computer room at the county voting machine warehouse, (Mahoney Test., 2/23 Trial Tr. at 116:17 to 117:9), stacked and labeled by town. (Mahoney Test., 2/23 Trial Tr. at 98:12-99:5, 116:17 to 118:10.) Paula Sollami-Covello testified that results cartridges in her county are also stored at a county warehouse. (Sollami-Covello Test., 2/24 Trial Tr. at 62:4-7.)

The cartridges are also often left unattended in open voting machines where both county workers and outside vendors can access them. Election mechanics are given unfettered access

to DREs. (Mahoney Test., 2/23 Trial Tr. at 99:17-100:21, 103:12-34, 118:2-14.) When Bergen County upgraded the DRE software, outside vendors were given unfettered access to the machines for several weeks. (Mahoney Test., 2/23 Trial Tr. at 101:25 to 102:7, 102:12 to 103:24.)

Prof. Appel also explained that it is "very easy" and requires "very little technical skill" to make fake results cartridges to include an inexpensive, wirelessly-enabled, radio-controlled flash memory card. (See Appel Report, §§ 47.5,47.11; Pa631-32.) Even a college student could "make a 'smart' results cartridge that fools the motherboard." (Appel Report, § 48.1; Pa632.) A "poll worker, election worker,... or a voter" could easily attack the cartridge wirelessly from several feet away, (Appel Report, § 47.7; Pa631), to manipulate ballot data and election results while the cartridge is installed in DRE or after its removal. (Appel Report, § 47.11, § 48.3; Pa632.)

It would not be easy for a poll worker or election official to detect fraudulent cartridges, which "have the same appearance as ordinary cartridges," (Appel Report, § 48.5; Pa633), and would be designed with a computer program inside, (Appel Report, § 48.3, § 48.6; Pa632-33), to steal votes "in election after election" with no human intervention. (Appel Report, § 48.6; § 6.15; Pa633-57.)

Because there are no uniform, statewide policy or procedures for where counties count votes from cartridges, (Giles Test., 3/3 Trial Tr. at 155:3-17, 155:20-23, 157:1-8), results cartridges can be altered or replaced while they are being transported after the election. (Appel Test., 1/29 Trial Tr. at 101:7-9, 103:21 to 104:3; Appel Test., 2/4 Trial Tr. at 55:17 to 56:18; Appel Report, § 40.1-40.2, § 40.6, § 40.8; Pa621-23.)

Mr. Giles testified that votes may be counted by municipal workers rather than by county workers. (Giles Test., 3/3 Trial Tr. at 157:10-25, 161:6-9) and the Court acknowledged that results cartridges are sometimes brought to a municipal clerk, who sends data electronically to the county clerk. (See Shamos Test., Trial Tr., 3/23,156:7-157:6.)

In Union County, Joanne Rajoppi instituted procedures to protect election results. Results cartridges and reports are transported directly to municipal clerks, (Rajoppi Test., Trial Tr., 2/26 at 45:17-22, 46:9-13,131:12-19), whereafter sheriffs transport the cartridges to “satellite offices” to be read (Rajoppi Test., 2/26 Trial Tr. at 41:1-7, 44:2-45:14, 45:25-46:2.), before they are stored with the county clerk. (Rajoppi Test., 2/26 Trial Tr. at 41:1-19, 44:2-45:14, 45:6-7, 45:25-46:2, 47:9 to 48:5, 49:10-11, 49:19-20, 51:8-12.) Ms. Rajoppi’s “exemplary practice” of results cartridge security (Appel Report,

§41.7; Pa624), however, does not protect the cartridges immediately after they leave the polling place.

By contrast, in Mercer County, results cartridges are transported to municipal clerks' offices, where county workers pick them up. (Sollami-Covello Test., 2/24 Trial Tr. at 66: 1-3, 61:5-7.) Afterwards, every cartridge is read at the county clerk's office. (Sollami-Covello Test., 2/24 Trial Tr. at 61:6-7, 61:9-13, 62:10-14.) James Clayton of Ocean County and Daryl Mahoney of Bergen County testified to similar practices in their counties. (Clayton Test., Trial Tr., 3/3 at 58:9-59:1-5; Mahoney Test., 2/23 Trial Tr. at 122:14-20, 123:10-21, 123:25 to 124:4.)

Thus, in Mercer, Ocean, and Bergen County, results cartridges can be manipulated by poll workers or municipal workers en route to the municipal clerk, (Appel Test., 1/29 Trial Tr. at 101:7-9, 103:21 to 104:3; Appel Test., 2/4 Trial Tr. at 55:17 to 57:19; Appel Report, § 39.2, § 39.6, § 40.1-40.2, § 40.6, § 40.8; Pa619-623; Sequoia Voting Systems, Inc., AVC Advantage Security Overview (2004)), and by county workers en route to the county clerk. (See Clayton Test., 2/24 Trial Tr. at 58:17-24; Sollami-Covello Test., 2/24 Trial Tr. at 60:19-61:17; Mahoney Test., 2/23 Trial Tr. at 122:7-123:18; Appel Test., 1/29 Trial Tr. at 101:7-9, 103:21 to 104:3; Appel Test., 2/4 Trial Tr. at 55:17 to 57:19; Appel Report, § 39.2, § 39.6, §

40.1-40.2, § 40.6, § 40.8; Pa619-23; Sequoia Voting Systems, Inc., AVC Advantage Security Overview (2004)).

The State did not present any witnesses to rebut Prof. Appel's testimony about the insecure nature of results cartridges. Indeed, Dr. Shamos examined how cartridges could be manipulated after being removed from voting machines after the election, en route to the county clerk's office. (Shamos Test., 3/23 Trial Tr. at 42:1-11, 95:12-15, 116:1-9; Shamos Test., 3/24 Trial Tr. at 119:12-16, 128:15-129:5; Shamos Test., 3/25 Trial Tr. at 144:12-18; Ex. D-21 at ¶ 89.)

The State also presented no testimony whatsoever to show there are safeguards in place which ensure election results recorded on results cartridges are protected against manipulation. Indeed, the State concedes that manipulation by insiders is a significant threat to election results. The State's expert witness, Dr. Shamos, testified that the principle threat security experts worry about is what insiders can do because insiders do not have to defeat the physical security. (Shamos Test., 3/23 Trial Tr. at 116:1-7; Ex. D-21 at ¶ 89; Shamos Test., 3/24 Trial Tr. at 119:12-16.) He also noted "[i]t is of course important to institute procedures to ensure that insiders cannot mount the attacks proposed, or to ensure that any intrusion will be detected." (Shamos Test., 3/23 Trial Tr. at

116:1-7; Ex. D-21 at ¶ 89; Shamos Test., 3/24 Trial Tr. at 119:12-16.)

F. The State Does Not Require That Signed, Printed Result Reports Be Compared Against Results Cartridge Results.

Robert Giles testified that he has not instituted a requirement that county clerks compare the results cartridge with paper results report printouts. (Appel Report, § 41.1-2, § 45.3; Pa623-624; Appel Test., 2/4 Trial Tr. at 26:7-20, 52:2-19; Appel Test., 1/28 Trial Tr. at 5:11-24, 43:14-24; Giles Test., 3/3 Trial Tr. at 161:6-9, 162:8-10; Sollami-Covello Test., 2/24 Trial Tr. at 64:13-17; Rajoppi Test., 2/26 Trial Tr. at 52:13-16, 63:10-14, 66:17-22, 66:23-25.)

Comparing paper results reports with cartridge results can detect changes made to election results in the results cartridge after the paper report is printed. (Appel Report, § 3.2; Pa547; Appel Test., 1/28 Trial Tr. at 47:11-19, 52:20-23, 66:1-3; see generally Appel Test., 1/28 and 1/29 Trial Tr.) In sum, New Jersey counties rely on results cartridges for official election data, paying scant if no attention to the printed results tape produced by the DREs at the close of the polls that are signed by witnesses. Uncontroverted evidence was presented at trial that election data stored on results cartridges is easy to manipulate. This evidence was not contradicted or rebutted by any defense witnesses. As Dr. Shamos testified, poll workers and

election workers have many opportunities to manipulate the data, and pose a real risk to election results.

Although vulnerable to tampering by the replacement of a DRE's firmware, (Appel Test., 2/4 Trial Tr. at 26:7-20, 52:2-19; Appel Test., 1/28 Trial Tr. at 43:14-24; Appel Report, § 41.1-2; Pa623), printed results reports produced by DREs on election night are vulnerable to fewer kinds of fraudulent tampering than results cartridges. Thus, results reports are a more accurate source of election results. (See Giles Test., 3/3 Trial Tr. at 155:3-17, 155:20-23, 157:1-8, 161:6-9; ; see also Appel Test., 1/28 Trial Tr. at 5: 13-24, 43:14-24; Appel Test., 2/4 Trial Tr. at 26:7-20, 52:2-19; Appel Report, § 41.4, § 41.1-2; Pa623-624.)

Despite this, there is no statewide requirement that results reports be compared against cartridge data. (Giles Test., 3/3 Trial Tr. at 154:3-11, 155:20-23, 157:1-8, 161:6-9; Appel Test., 2/4 Trial Tr. at 26:7-20, 52:2-19; Appel Test., 1/28 Trial Tr. at 43:14-24; see Appel, Tr., 1/28 Trial Tr. at 5:13-24.) This is still the case, even though during the 2008 Presidential primary, comparing results reports against cartridge data in eight counties demonstrated many inconsistencies between printed results reports and election results stored on results cartridges.

V. THE STATE'S HAPHAZARD ATTEMPT TO DEVISE "SECURITY MEASURES" FOR USE ON DREs ONLY DEMONSTRATED THE STATE'S INCOMPETENCE.

A. Security Seals And Measures Proposed For Use By The State Were All Readily Defeated By Appellants' Experts.

After Prof. Appel presented his expert report to the trial court enumerating the myriad of ways that the Sequoia Advantage DREs could be hacked, the Appellees began proposing a series of security measures. They withdrew each measure as quickly as they introduced it. Between November 2008 and the close of trial in May 2009, the Appellees introduced no less than thirteen different seals that they considered installing in the AVC Advantage. (Johnston Test., 4/21 Trial Tr. at 78:20.) Those proposed security measures include the: (1) plastic strap seal; (2) red adhesive tape with a New Jersey state seal; (3) wire cable lock seal; (4) large cup seal; (5) blue plastic strap seal; (6) revised blue plastic strap seal; (7) small Brooks MRS pressure-sensitive seal with ultraviolet markings; (8) large Brooks MRS2 pressure-sensitive seal; (9) Brooks padlock seal; (10) small cup seal; (11) small cup seal with Gorilla Glue; (12) large cup seal with Gorilla Glue; and (13) Brooks red adhesive tape seal. 12/1/08 Appel Cert. ¶ 5 at 3; Ex. P-32; Pa796.) Indeed, on May 11, 2009, the last day of trial, the Appellees were still attempting to introduce new security measures. (Giles Test., 5/11 Trial Tr. 68:21-71:9.)

The trial court permitted the Appellees to introduce new security measures throughout the course of the five month trial. Appellants' expert witnesses, who are not lock pickers and thieves (but rather world-class scientists), were expected to defeat them, in Court, in their coats and ties, with almost no previous notice. This created a circus-like atmosphere that was unfair to the Appellants. Nonetheless, Appellants' experts defeated every security seal presented by the Appellees.

B. The State's Haphazard Approach To Physical Security Does Not Protect DREs.

The trial court heard extensive testimony about the poor physical security of New Jersey's DREs from Dr. Johnston. Ross Anderson, Prof. of Security Research at Cambridge University, has written that "the most impressive physical security research team in the world is probably Roger Johnston's Vulnerability Assessment Team." (Johnston Expert Report, at 47; Pa1114.)

The Appellees never called any witnesses with any expertise in physical security. Thus, Dr. Johnston's testimony is the only testimony before the Court on the subject of physical security as it relates to New Jersey's DREs. His conclusions — that New Jersey has no security culture, and that the Appellees' proposed secret measures can be defeated without detection — remain uncontested.

1. Dr. Johnston Concluded That New Jersey Does Not Have An Effective Security Protocol in Place.

Dr. Johnston testified that "one can't have good security no matter how good the hardware if one doesn't have a good security culture." (Johnston Test., 4/21 Trial Tr. at 19:2-6.) An organization with a healthy security culture, according to Dr. Johnston, builds security into everything it does, at every level: it engages in critical self-review; approaches security proactively; incorporates a desire to improve security into every level of the organization; and eagerly solicits input on security from all quarters, both internal and external. (Johnston Test., 4/21 Trial Tr. at 57:19 to 58:4.) It does not wait passively for security problems to be pointed out by an external agent, (Johnston Test., 4/21 Trial Tr. at 57:9-16), or respond in an ad hoc way to vulnerabilities by "slapping on" some third-party solution. (Johnston Test., 4/21 Trial Tr. at 58:3.) Indeed, as Dr. Johnston testified, a healthy security culture regards security not as a commodity for sale, but as an ongoing process integral to all operations. (Id.)

Dr. Johnston concluded that New Jersey suffers from an unhealthy security culture with regard to its DREs, making elections conducted on the DREs vulnerable to numerous attacks. Perhaps no better indication of New Jersey's unhealthy security culture was its approach to security seals on the eve of trial

and during trial. Dr. Johnston examined no fewer than thirteen seals since he became involved in this case in 2009. (Johnston Test., 4/21 Trial Tr. at 78:20.) The Appellees' poorly planned and hasty introduction, withdrawal, and re-introduction of seals did not make DREs safer in any way. (Johnston Test., 4/21 Trial Tr. at 79:25 to 80:5.) Evidence of this is that Prof. Appel, who is a not a burglar, defeated all of the seals proposed by the Appellees.

The Appellees did not consult any independent security experts before introducing security seals. (Johnston Test., 4/21 Trial Tr. at 79:7-10.) Additionally, the Appellees changed seals in response to advice gleaned from Appellants' expert testimony; a reactive, rather than a proactive, approach. (Id.) The Appellees' ad hoc measures leave the DREs open to multiple attacks. (Johnston Expert Report, § 64, Pa1079.)

Dr. Johnston's opinion is that New Jersey, like other "organizations with poorly thought-through security pile[s] on multiple security features, devices, or layers in hopes that the complex interaction of all these layers will somehow automatically add up to good security." (Johnston Expert Report, § 95; Pa1084; Johnston Test., 4/21 Trial Tr. at 166:18-25.) He testified, further, that it takes at least several months per seal of intensive work and training to develop

effective seal use protocols. (Johnston Test., 4/21 Trial Tr. at 79:18-24.)

The sheer number of seals proposed by the Appellees before and during trial demonstrate the State's lack of knowledge on how to develop a coherent security policy for New Jersey's DREs. (Johnston Test., 4/22 Trial Tr. at 120:24-25.) New Jersey, at the close of trial, proposed to use six different seals in nine locations on its DREs. Dr. Johnston testified that in seventeen years at the forefront of his field, he has never seen so many seals used at once, including on top-secret nuclear safeguards and other high-level national-security applications. (Johnston Test., 4/21 Trial Tr. at 120:2-7.) The most seals he has ever seen in one application was three. (Johnston Test., 4/21 Trial Tr. at 120:14-16.)

This is because in order to have effective security systems, security professionals consciously minimize the complexity of their programs. (Johnston Test., 4/21 Trial Tr. at 120:16-21.) Each new seal added to a system multiplies the complexity of the use protocols necessary to ensure its effectiveness. (Id.) As Dr. Johnston testified, "with security, as with many things in life, simplicity is the best approach." (Johnston Test., 4/21 Trial Tr. at 121:10-11.) Complexity, on the other hand, both compounds the cost of a security program and introduces new vulnerabilities. (Johnston Test., 4/21 Trial Tr. at 120:1-2.)

Without rigorous protocols governing every aspect of their use, security seals will not provide effective security. (Id.) Seal use protocols should govern seals "from cradle to grave:" how they are chosen, procured, used, transported, installed, inspected, removed, disposed of, how training is done, who the personnel are, and so on. (Johnston Test., 4/21 Trial Tr. at 80:23-24.)

2. The State Took the Advice of Vendors on What Seals to Use.

Dr. Johnston testified that in developing a healthy security culture, it is essential to seek advice from on-staff and external security experts. (Johnston Test., 4/21 Trial Tr. at 60:1-9.) New Jersey has no on-staff security experts, and has consulted no physical security experts. (Johnston Test., 4/21 Trial Tr. at 60:19-22.) Trial testimony revealed that the State relied exclusively upon the manufacturers of the seals for security advice, particularly the Brooks Company. (Johnston Test., 4/21 Trial Tr. at 60:1-10.) The conflict of interest should be obvious: a seal manufacturer has a financial interest in selling seals. (Id.) This does not take into account the security interests of its clients. (Johnston Test., 4/21 Trial Tr. at 60:1-10.) Indeed, seals that Mr. Giles testified were recommended by Brooks as being foolproof were readily defeated by

both Dr. Johnston and Prof. Appel. (See, e.g., Johnston Expert Report, §106; Pa1088.)

3. Mr. Giles' Lack Of Understanding Of Security Issues Exacerbates The Vulnerabilities Of New Jersey's DREs.

According to Dr. Johnston, the fact that Mr. Giles, the Director of the Division of Elections, does not understand physical or cybersecurity illustrates New Jersey's poor security culture. (See Johnston Test., 4/21 Trial Tr. at 58:5 to 64:3.) Dr. Johnston's expert report emphasizes that security depends crucially on organizational security culture and priorities. (See Johnston Expert Report, §36; Pa1073.) As Director of the Division of Elections, Mr. Giles' own attitudes and understanding have a tremendous affect on New Jersey's election security. (Johnston Expert Report, § 62, Pa1079.)

After reading Mr. Giles' deposition, Dr. Johnston concluded that "[i]n my professional opinion, Mr. Giles' views represent major barriers to having good election integrity, and show evidence of an unhealthy security culture." (Johnston Expert Report, § 62, Pa1079.)

Dr. Johnston identified even more indicators of poor security culture in New Jersey by examining the depositions of James Clayton of Ocean County, Elisa Gentile of Hudson County, and Daryl Mahoney of Bergen County. (Johnston Test., 4/21 Trial Tr. at 67-69.) He laid special emphasis on security vulnerabilities

in the transport, storage, and delivery of DREs. (Id.) These flaws create genuine security vulnerabilities. (Johnston Test., 4/21 Trial Tr. at 67:14-21, 68:1-8; citing Mahoney Deposition, at 32-36, 58-60, 67:23 to 68:8, and 67:1-11; Gentile Deposition, at 63-67, 89-91, 93-95; see also Johnston Expert Report, § 86, citing Clayton Deposition, at 66-68; Pa1082; Johnston Expert Report, § 89, citing Mahoney Deposition, at 58-60; Pa1083; Johnston Expert Report, § 92, citing Gentile Deposition, at 91, 93-95; Pa1083.)

On the basis of his research, and after reading the depositions of the witnesses named directly above, Dr. Johnston's conclusion is that

> [g]iven limited security features built into the AVC Advantage voting machine, the absence of a healthy security culture for New Jersey elections, and New Jersey's lack of well designed seal use protocols, I believe there are viable attacks on New Jersey voting machines that are ... capable of affecting election results.

(Johnston Expert Report, § 93; Pa1083-84; see also Johnston Test., 4/21 Trial Tr. at 58:19-21.) New Jersey's poor security culture creates the possibility that an election may be stolen. (Johnston Expert Report, § 93; Pa1083-84.)

C. Retroactively Adding Security Products To An Insecurely Designed System Does Not Work; In Such Instances, Dr. Johnston And His Team Recommend Exploring Different Security Approaches.

Ultimately, Dr. Johnston concluded that no amount of retrofitting can remedy the inherent security flaws in New Jersey's proposed seals program. Dr. Johnston's expert opinion is that retrofitting a poorly designed system is never successful. (Johnston Test., 4/22 Trial Tr. at 155:5-21.) For a system to be secure, it must be designed securely, not modified as an afterthought. (Id.) Such efforts are not only costly, but futile in terms of security. (Id.) For that reason, Dr. Johnston's Vulnerability Assessment Team does not hesitate to recommend replacing an insecure system with one that is designed from the ground up with security in mind. (Id.)

Dr. Johnston testified that no security seals can cure the engrained designed flaws in New Jersey's DREs. (Johnston Test., 4/22 Trial Tr. at 155:5-21; Johnston Expert Report, ¶ 64; Pa1079.)

Perhaps in response to Dr. Johnston's strong testimony, in her March 8, 2010 Order, the trial court ordered the Appellants' to devise a seal use protocol to protect the State's DREs. The Appellants missed several deadlines before submitting documents to the trial court. Unfortunately, the Appellants cannot

comment on the Appellees seal use protocol as the Appellees and the trial court shut them out of the process.

Although initially Appellants were given access to preliminary drafts of the State's proposals, after Dr. Johnston critiqued those proposals and found them inadequate, the Appellees stopped providing the Appellants with information.

The trial court refused to grant Appellants' and their experts permission to examine the seal use protocol and denied Appellants' requests for evidentiary hearings. (Hr'g Tr. 49:23-50: 1, Dec. 1, 2010). Appellants believed that such evidentiary hearings, where cross-examination of witnesses would be permitted, were necessary for the court to adequately determine whether the Appellants' proposed seal use protocol would be effective in protecting the State's DREs. Appellants are appealing the trial court's decision. (See § VA2 of the "Legal Argument" Section of this Brief.)

VI. APPELLANTS' EXPERTS' ARE BETTER QUALIFIED TO ASSESS THE RELIABILITY AND ACCURACY OF THE SEQUOIA ADVANTAGE 9.00H.

All of Appellants' expert witnesses have been working on this lawsuit pro bono. (Appel Test., 2/5 Trial Tr. at 61:6-15.) (Johnston Test., 4/23 Trial Tr. at 121:15-17; Johnston Test., 4/24 Trial Tr. at 111:6-18.)

A. Appellants' Experts Are Better Qualified.

An expert's qualifications and experience are highly relevant to evaluating the credibility of the expert's testimony. Appellants' experts - Prof. Andrew Appel, Dr. Roger Johnston, and Prof. Wayne Wolf - possess outstanding credentials, knowledge, and experience, making them substantially better qualified to assess the reliability, accuracy, and security of the Sequoia Advantage 9.00H than Appellees' experts.

1. Prof. Andrew Appel:

Prof. Appel is an extraordinarily qualified witness in the areas of computer science, computer security, the Sequoia Advantage DRE, and the WinEDS system. He received a Bachelor's degree in physics with highest honors from Princeton University in 1981, specializing his undergraduate work in applications of computer science to physics. (Appel Test., 1/27 Trial Tr. at 82:14-23, 83:16 to 84:1.) He proceeded to earn a Ph.D. in computer science from Carnegie Mellon University in 1985, focusing his Ph.D. research in methods of reasoning to ensure the correctness and accuracy of computer software. (Id. at 84:2-11 and 13-16).

Prof. Appel's employment history also makes him uniquely qualified to render an opinion in this case. Prof. Appel served as a computer science consultant for Bell Laboratories for many years. (Id. at 85:6-20.) He has been a Prof. of computer

science at Princeton University since 1986, tenured since 1992, and a full Prof. at Princeton since 1995. (Id. at 80:22 to 81:3.) Prof. Appel teaches courses in software engineering, programming languages, compilers, and election machinery - a course that involves not only voting machines, but also political party machines, and the machinery of election administration by public officials. (Id. at 87:22-25, 88:1-5.) He also teaches computer security in the context of software engineering courses at the sophomore level, and supervises and advises graduate students who conduct computer security research. (Id. at 88:6-13.) In addition to teaching, Prof. Appel has an appointment to the Center for Information Technology Policy at Princeton, an interdisciplinary center that studies the intersection between computer science and public policy. (Appel Test., 1/27 Trial Tr. at 86:14-25.) Prof. Appel served as Associate Chair of the Department of Computer Science at Princeton University for approximately ten years between 1996 and 2005, and later became the Chair of the Computer Science Department. (Id. at 87:12-21.)

Prof. Appel has been conducting computer science research since 1980, and researching computer security in particular since 1994. (Id. at 93:20-24.) His extensive scientific research ranges from theoretical aspects of computer security that overlap with programming languages and formal methods, to practical

computer security topics, such as securing enterprise computer networks, physical security, and security of computer memory systems, among others. (Id. at 89:1-9.)

Prof. Appel has continuously been awarded research grants for his professional work, including a grant from the National Science Foundation for research in programming languages, compilers, and computer security. (Appel Test., 1/27 Trial Tr. at 92:24 to 93:2-8.) He has also received research grants from the Defense Advanced Research Projects Agency for research in computer security, and from the Advanced Research and Development Activity, a funding agency within the United States Intelligence Community. (Id. at 93:8-12.) He recently received a grant for research in computer security from the Air Force Office of Scientific Research. (Id. at 93:13-16.) In addition to grants from government agencies, Prof. Appel has also received research grants from many corporations, such as IBM, Microsoft, and Sun Microsystems. (Id. at 93:17-19.)

Prof. Appel has earned numerous accolades and appointments in the computer science field. Since 1998, he has been an honorary Fellow in the Association for Computing Machinery, an international professional society of computer scientists, both in academia and industry, with tens of thousands of members. (Appel Test., 1/27 Trial Tr. at 92:3-5, 7-13.) Prof. Appel has also served as a member of the program committee, or a chair of the

program committee, of several different conferences on computer science, which included topics such as programming languages, compilers, logic, and voting machines. (Appel Test., 1/27 Trial Tr. at 96:21 to 97:4-8, 12.) He has been an associate editor of two journals, and has served as editor-in-chief for the Association for Computing Machinery's journal, during which time he supervised hundreds of papers through the publication process, including papers on computer security. (Id. at 95:15-21 96:13-20.) Prof. Appel's curriculum vitae enumerates ninety publications, of which eighty-three, including two books and a chapter of another book, were published in peer reviewed venues. (Id. at 94:4-24.)

Prof. Appel was certified by this Court as an expert in computer science and computer security, as well as an expert on the Sequoia AVC Advantage DRE that is the subject of this trial. (Id. at 98:7-14, 130:18-20.) His Expert Witness Report was admitted into evidence as plaintiffs' Ex. P-2; Pa532. Appellees called no witness to rebut the scientific testimony of Prof. Appel. His conclusions that New Jersey's DREs are unreliable and insecure are uncontested.

2. Dr. Roger Johnston:

Appellants' second expert, Dr. Roger Johnston, is one of the world's leading experts regarding issues of physical security and security culture, and thus was highly qualified to provide

testimony about the poor physical security of New Jersey's DREs. Dr. Johnston earned both an MA and Ph.D. in physics from the University of Colorado in 1983. (Johnston Test. 4/21 Trial Tr. at 12:12-14.) He is employed as a Senior Systems Engineer at Argonne National Laboratories, a federal laboratory owned by the Department of Energy and run by the University of Chicago. (Id. at 11:7-11; see also Expert Report of Roger G. Johnston, Docket No. MER-L-2691-04 at 47-59 (hereinafter "Johnston Expert Report"), Ex. P-81; Pa1068.) Dr. Johnston is Section Manager of Argonne's Vulnerability Assessment Team, which examines security devices, systems and programs, identifies flaws, and recommends countermeasures. (Johnston Test., 4/21 Trial Tr. at 15:4-14.) His team at Argonne works on projects with sensitive national security implications, including nuclear safeguards and security applications. (See Johnston Expert Report, at 47; Pa1114.) Dr. Johnston's work has made him one of the world's preeminent experts on security. (Id.)

Before working at Argonne, Dr. Johnston founded the Los Alamos National Laboratories Vulnerability Assessment Team, and spent fifteen years as its Team Leader. (Id. at 4.) There, Dr. Johnston worked on projects involving homeland security, nuclear safeguards and nonproliferation compliance, counter-terrorism, biophysics, chemistry, and laser applications, in addition to security seals and tamper detection. (Id. at 46.) He has also

consulted for the Department of Energy, the Department of Defense, the Nuclear Regulatory Commission, the National Institutes of Health, and numerous private corporations. (Johnston Test., 4/21 Trial Tr. at 49.)

Over the past twenty years, Dr. Johnston has studied hundreds of kinds of security seals, and published over 115 articles on seals and security. (Id. at 20:11-14.) He is Editor of the Journal of Physical Security, and holds a U.S. government Top Secret Q clearance, allowing him to study seals used on nuclear safeguards and other sensitive national-security applications. (Johnston Expert Report, at 49; Pa1116; Johnston Test., 4/21 Trial Tr. at 11:14-12:4.) Within this "top secret" security clearance designation, his security level was upgraded since the trial to "top secret/SCI." (Johnston Certif. ¶37, Oct. 14, 2010; Pa457.) Dr. Johnston has won numerous awards and fellowships, including several research and achievement awards at Los Alamos, and a Distinguished Performance Award from the Central Intelligence Agency in 2002. (Johnston Expert Report, at 47; Pa1114.) From 2001-2002, he was a Science Fellow at the Center for International Security and Cooperation at Stanford University. (Johnston Expert Report, at 46; Pa1113.)

In its Rule 104 Hearing of April 21, the Court certified Dr. Johnston to give expert testimony on everything covered by the expert report he submitted, along with its addendum. (Johnston

Test., 4/21 Trial Tr. at 49:24 to 50:4.) Dr. Johnston's Expert Report was admitted into evidence as Plaintiffs' Ex. P-81; Pa1068. Under the Court's certification, Dr. Johnston's expertise covered all aspects of physical security, including security seals, security culture, physical vulnerabilities, attacks on seals, inspections, backdoor attacks, DRE storage, and background checks. (Id. at 47:1 to 48:25.) Appellees did not call any witnesses with expertise in physical security. Thus, Dr. Johnston's testimony is the only testimony before the Court on the subject of physical security as it relates to New Jersey's DREs. His conclusions - that New Jersey has no security culture, and that the Appellees' proposed seals can be defeated without detection - are uncontested by any expert or evidence.

3. Prof. Wayne Wolf:

Appellants' third expert, Prof. Wayne Wolf, possesses outstanding credentials and qualifications in the field of processor design and embedded security. Prof. Wolf serves as Prof. Rhesa, Ray. S. Farmer, Jr., Distinguished Chair of Embedded Computing Systems and Georgia Research Alliance Eminent Scholar at Georgia Institute of Technology. (Wolf Test., 5/11 Trial Tr. at 5:9-20; Wolf Report, ¶ 1; Ex. P-117; Pa1191.) He received his Bachelor's degree, Master's degree, and Ph.D. in Electrical Engineering from Stanford University. Following the receipt of his Ph.D. in 1984, Prof. Wolf accepted a position as

Prof. at Princeton University and subsequently joined the faculty at the Georgia Institute of Technology in 2007. (Wolf Test., 5/11 Trial Tr. at 14-23.) He has also held several industry positions since receiving his Ph.D., including consulting for several companies and holding leadership titles at Media Works Technology in 2001 and 2002. (Wolf Test., 5/11 Trial Tr. at 8:24 to 9:5.) He currently holds the positions of director, secretary, and vice-president at Verificon Corporation. (Wolf Test., 5/11 Trial Tr. at 9:3-5.)

Prof. Wolf has been involved with several notable and relevant publications. He was the founding editor-in-chief of the journal for the Association for Computing Machinery ("ACM"), TRANSACTIONS ON EMBEDDED COMPUTER SYSTEMS. (Wolf Test., 5/11 Trial Tr. at 12-19.) He also served as editor-in-chief of the Institute of Electrical and Electronics Engineers ("IEEE") journal, TRANSACTIONS ON VSLI SYSTEMS. (Id.) Prof. Wolf has authored four major textbooks, including texts on VSLI ("Very Large Scale Integration"), FPGA-based system design, and embedded computing. He has conducted extensive research on microprocessors and has taught classes on microprocessors and embedded computing at Princeton and Georgia Tech. (Wolf Test., 5/11 Trial Tr. at 9:5-23; 12:4 to 14:4.)

Further, Prof. Wolf has received many distinguished awards for his work on computer systems, including the Frederick E.

Terman Award from the American Society for Engineering Education. (Wolf Test., 5/11 Trial Tr. at 15:5-9.) He has also been named a Fellow of both the IEEE and the ACM. (Id. at 15:10-11.)

Prof. Wolf was certified as an expert in microprocessors, including embedded computing, logic design, and VLSI design. (Id. at 24:2-15.) He was also certified as an expert in embedded system security. (Id. at 24:14 to 26:16.) His Expert Report was admitted into evidence as Plaintiffs' Ex. P-117; Pa1190.

B. Appellees' Experts Are Not Qualified To Issue Opinions Concerning New Jersey's DREs.

The qualifications, backgrounds, and experiences of Appellants' experts are far superior to those of Appellees' three expert witnesses, who lack the necessary qualifications to render their opinions credible.

Appellees' first expert, Dr. Michael Shamos, lacks qualifications as a computer security expert. While Dr. Shamos may have a Ph.D. in computer science, he has a very thin publication history, and those publications are not particularly germane to any matters related to this case. (Trial Exs. D-20, D-21.) His published articles ranging in topics from the piezoelectric effect in bone to mathematics, intellectual property law, worker's compensation, and academic titles. Conspicuously absent from this extensive list is a single publication about computer security. (Id.) Further, although

Dr. Shamos lists five books on his resume, four of them are different translations of the same book - a textbook on computational geometry, a field generally associated with computer graphics - and the other book is merely a directory of academic titles used at Carnegie Mellon University. (Shamos Test., 3/23 Trial Tr. at 63:9-13, 16-24.) Dr. Shamos does have some sparse writings on the subject of voting, but he concedes that these are mostly about the history of voting, rather than current practices. (Shamos Test., 3/23 Trial Tr. at 73: 20-23.) He has written no books on computer security or voting, and his papers about voting mostly consist of papers delivered at conferences, not peer reviewed publications. (Id. at 64:14-16,73:24 to 74:3, Ex. D-20.)

Moreover, despite a thirty-four year affiliation with Carnegie Mellon University, Dr. Shamos is only adjunct faculty and is not a tenured Prof. at the institution. (Shamos Test., 3/23 Trial Tr. at 60:19-61:3.) During most of his affiliation with the University, he has not been engaged in scientific research in the field of computer science, but has instead practiced law and written dozens of articles and books on billiards. (Id. at 61:1-5, 68:6-11.)

Unlike Prof. Appel, Dr. Shamos does not advise any Ph.D. students, and has not received any recent awards in the field of computer science. (Id. at 62:13-14; Shamos Test., 3/24 Trial Tr.

at 69:8-13.) The last awards Dr. Shamos won related to computer science are from twenty and thirty years ago; he has contributed little to the development of the rapidly evolving field since then. (Shamos Test., 3/24 Trial Tr. at 69:8-13.) In fact, the only awards received by Dr. Shamos since that time have been in fields such as law, billiards, and bagpipes. (Shamos Test., 3/23 Trial Tr. at 69:14-23.)

Dr. Shamos has served as an expert in other Sequoia litigations and has received hundreds of thousands of dollars in compensation from Sequoia. (Shamos Test., 3/24 Trial Tr. at 89:6-11-96:7; 25:25-26:6.)

Appellees' remaining expert witnesses, Edwin Smith and Paul Terwilliger, are in fact employees of Sequoia. Prior to the commencement of trial, the Appellees never indicated any intent to call Mr. Smith and Mr. Terwilliger as expert witnesses in support of its case. On January 27, 2009, just before the start of trial, the Court ruled that Dr. Shamos would not be allowed "to testify as to whether in his opinion the voting machines are scientifically accurate or reliable." (Colloquy, 1/27 Trial Tr. at 38:4-6.) One week later, on February 4, 2009 at 6:04 p.m., four days into trial, and after being in Court with Appellants' counsel all day, Appellants' counsel received (via email) a letter from the State stating that the "State defendants intend to call Sequoia representatives Ed Smith and Paul Terwilliger as

experts in our case-in-chief." This was the very first time that Appellants were notified in writing of the Appellees' intention to convert Mr. Smith and Mr. Terwilliger from fact witnesses to expert witnesses. (Colloquy, 2/5 Trial Tr. at 4:13-6:3.)

Not surprisingly, Mr. Smith and Mr. Terwilliger do not possess impressive credentials and qualifications for providing an expert opinion. For example, Mr. Smith holds degrees in mechanical engineering and business administration (the later from an unaccredited university), not in computer science or computer engineering. (Smith Test., 3/18 Trial Tr. at 59:23 to 61:10.) Likewise, Mr. Terwilliger does not hold any degrees in computer science or computer engineering, has never held any academic appointments or published any articles in peer-reviewed journals, and has had no professional speaking engagements other than sales-related presentations. (Terwilliger Test., 3/30 Trial Tr. at 24:25 to 26:7-24.) In addition to lacking the qualifications and background necessary to render credible expert opinions, Mr. Smith and Mr. Terwilliger, as employees of Sequoia, are heavily biased as their only income is derived from Sequoia.

In sum, the qualifications, educational backgrounds, and relevant experiences of Appellants' experts far exceed those of Appellees' experts. Thus, Appellants experts are better qualified to assess the reliability and accuracy of the Sequoia

Advantage 9.00H, and their opinions should be afforded greater weight by this Court than the opinions of Appellees' experts.

C. Appellants' Experts Examined The DREs And Security Seals.

Prof. Appel's personal study of Sequoia AVC Advantage 9.00H DREs provides a rock solid scientific foundation for his expert opinion. In connection with this lawsuit, in July and August 2008, Prof. Appel and a team of computer scientists examined two Sequoia AVC Advantage 9.00H DREs voting machines provided by Appellees. (Appel Report § 1.3, at 7; Pa538; Appel Test., 1/27 Trial Tr. at 118:20-24.)

Prof. Appel and his team spent an extraordinary number of hours inspecting and experimenting on the Advantage 9.00H DREs. During the month of July 2008, the team spent almost seven days a week examining the DREs, working from six to ten hours a day. (Appel Test., 1/27 Trial Tr. at 142:8 to 143:2.) These examinations looked at a number of aspects of the DREs, including, but not limited to, source code, operation of the DREs, and how the WinEDS database computers interact with the DREs. (Id. at 144:5-15.)

Following the thorough physical examination of the Sequoia 9.00H DREs, Prof. Appel wrote a lengthy and detailed report containing narrative descriptions of the various insecurities and inaccuracies in the DREs that he was able to uncover during the

thirty-day examination. (Id. at 143: 18-23.) In addition, on August 20 and 21, 2009, Prof. Appel created a videotape demonstrating inaccuracies and insecurities in the Sequoia DREs. (Id. at 147:22 to 148:3.)

Despite many limitations and difficulties imposed by Appellees on Prof. Appel's experiments,[10] Prof. Appel and his team were able to engage in much of the necessary examination of the DREs. (Appel Test., 1/27 Trial Tr. at 143:3-6.) They gave Prof. Appel a solid scientific foundation for the conclusions he reached in his expert report; the statements he made on his videotaped demonstration about the unreliability, insecurity and inaccuracy of the Sequoia DREs; and the elaborately detailed and

[10] Appellees erected numerous obstacles to Appellants' examination, depriving Prof. Appel and his team of the opportunity to perform some tests and procedures they would otherwise have conducted. For example, despite repeated promises to replace defective daughterboards after they ceased functioning, Defendants never did so, depriving Appellants of an opportunity to demonstrate numerous flaws in these components. Exs. P-22A, P-22B, P-22C, P-22D, P-22E; Pa753-62.) Further, despite having had months to prepare for the Court-ordered examination of the Sequoia DREs on June 30,2008, Sequoia produced a grossly incomplete subset of the source code, which failed to include the source code for numerous third party library files, lacked build tools such as a compiler, and completely lacked any source code, firmware, or configuration files for the operating system on the daughterboard. (Appel Report § 54.5-7 at 112-13; Pa643-44.) If given the time, Prof. Appel would have fabricated a fraudulent Z80 chip. (Appel Test., 1/28 Trial Tr. at 143:17-24.) This project would have taken Prof. Appel at least a month, and possibly as long as three months. (Appel Test., 1/29 Trial Tr. at 28:2-5.)

meticulously reasoned opinions he gave in his expert testimony before this Court. (Id.)

Appellants' experts have also examined the security seals introduced by the Appellees. Since becoming involved in this case in 2009, Dr. Johnston has examined no fewer than thirteen seals, all of which were introduced after discovery ended. (Johnston Test., 4/21 Trial Tr. at 78:20.) Dr. Johnston testified that in seventeen years at the forefront of his field, he has never seen so many seals used at once, including on top-secret nuclear safeguards and other high-level national-security applications. (Id. at 120:2-7.) He concluded that the unprecedented complexity of New Jersey's seals will overwhelm seal inspectors, as they struggle to do a good job on every seal under a more and more minutely detailed rubric. (Id. at 121:2-9.)

Further, during both direct and cross examination, Dr. Johnston demonstrated that simple, low-tech, inexpensive methods exist for defeating all of New Jersey's proposed seals. (Addendum to Johnston Expert Report, ¶ 32 at 6; Pa1073.) In open court, he defeated all of the seals contemplated by the Appellees, despite the fact that the Appellees continued changing its proposed seals as late as April 2009. (See generally Johnston Test., 4/23 Trial Tr. and 4/24 Trial Tr.; see also Addendum to Johnston Expert Report, ¶ 1; Pa1068.)

Moreover, Prof. Appel, who is not a burglar, was also able to defeat all the seals introduced by the Appellees. (Appel Test., 2/5 Trial Tr. at 15:13 to 54:4.) Even when confronted in cross-examination and forced to perform his hacks on the spot, Prof. Appel was able to break into the Sequoia Advantage 9.00H and replace the legitimate ROM chip with a fraudulent one.

Unlike Appellants' experts, Appellees' experts did not base their opinions on a physical examination of the equipment at issue, but rather on personal opinion and the Sequoia company's beliefs. In the 140 hours Dr. Shamos spent working on this lawsuit on behalf of the Appellees, Dr. Shamos never tested the Sequoia AVC Advantage 9.00H, and spent only one hour with the equipment. (Shamos Test., 3/24 Trial Tr. at 102:21 to 103:15.) Dr. Shamos described his interaction with the DRE by saying that he merely "exercised the machine so that I could see the effect of the option switch bug." (Id. at 103:10-12,104:18-20.)

Tellingly, Dr. Shamos did not examine or test the source code, firmware, or hardware of the AVC Advantage 9.00H, nor did he research the Appellees' proposed security seals. (Shamos Test., 3/24 Trial Tr. at 103:10-12, 104:18-20.) Appellants filed a motion in limine to exclude his testimony. As a result, the trial court held that Dr. Shamos could not testify about the security and accuracy of the Sequoia Advantage DRE. (Colloquy, 1/27 Trial Tr. at 38:4-6.)

Furthermore, both Mr. Terwilliger and Mr. Smith testified that they performed no tests, experiments, or measurements in connection with the assertions made in the Sequoia Response report. (Id. at 104:13-17,103:21-24, 120:13-18.) Therefore, Appellants' experts' opinions regarding the DREs and security seals merit greater credence than Appellees' experts' opinions, which were not based on an informed physical inspection of the equipment at issue in this litigation.

D. APPELLANTS' EXPERTS' OPINIONS AND BELIEFS ARE SHARED BY MEMBERS OF THE SCIENTIFIC COMMUNITY, WHILE APPELLEES' EXPERTS' OPINIONS ARE NOT.

The opinions and beliefs of Appellants' experts are generally shared by the scientific community, whereas the opinions and beliefs of Appellees' experts are not. The views of Appellants' experts are supported by the consensus of the scientific community. Prof. Appel testified that the consensus among experts in computer security who study voting systems is that software independence - verification of vote totals independently of the computer program used to count them - is the only reliable way of assuring security and accuracy in an election in which computers are used. (Appel Test., 2/4 Trial Tr. at 100:4-20; Appel Test., 4/14 Trial Tr. at 22:25 to 23:11; Appel Report, § 66.1, at 139; Pa670.) Currently, the only commercially available technology which achieves software independence is the voter-verified paper ballot, either in the

form of the precinct-based optical scanner or in the form of DREs that print a paper ballot. (Appel Test., 4/14 30:24 to 31:4; Appel Report, § 66.2, at 139; Pa670.)

Prof. Appel testified as to the superiority of precinct-based optical-scan systems, and recommends that New Jersey adopt this technology. (Appel Test., 2/4 Trial Tr. at 21:13-22, 101:3-18, 102:3-24; Appel Test., 2/9 Trial Tr. at 23-25, 114:4-13, 114:17 to 115:1, 115:22 to 116:1, 116:22 to 117:2; Appel Test., 4/14 Trial Tr. at 31:5-14, 32:1-17; Appel Report, § 67.10, § 67.11, § 67.3, § 67.12, § 67.6, § 67.7, § 67.8, Appel Report, § 67.9; Pa671-73. Optical-scan voting extremely accurate in Minnesota, Prof. Andrew Appel *112812008* Accessed *6/26/09* http://www.freedom-to-tinker.com/blog/appel/optical-scam-voting-extremely-accurate-minnesota.) This view is shared by the overwhelming majority of computer scientists and election technology experts, who have concluded that precinct-based optical-scan systems are the most trustworthy, robust, and cost-effective method of voting currently available. (Appel Test., 2/4 Trial Tr. at 101:3-18, 102:3-24; Appel Test., 4/14 Trial Tr. at 32:5-17; Appel Report, § 67.13, at 142; Pa673.)

The opinions of Appellees' experts, in contrast, are not shared by members of the scientific community. Significantly, Dr. Shamos is the only expert who supports paperless voting systems that cannot be independently audited by paper ballots. When

asked if he could identify any other computer scientists or computer security experts who agreed with his position that paperless DREs are superior to DREs that produce a voter-verified paper ballot, Dr. Shamos named just two individuals who might agree with this position. (Shamos Test., 3/23 Trial Tr. at 70:4-16; Shamos Test., 3/24 Trial Tr. at 83:8 to 84:17.) When further questioned about these individuals, however, Dr. Shamos admitted that they in fact supported software independence, precinct-based optical scanners, or a software independent voter-verified paper audit trail, not paperless DREs. (Shamos Test., 3/24 Trial Tr. at 83:25, 109:20 to 110:3, 113:4-7.)

In sum, Appellants' experts are far-better qualified than Appellees' experts to render an opinion in this litigation, as they possess superior credentials, knowledge, and experience, and have no bias or personal interest that could impair the objectivity of their testimony. Moreover, Appellants' experts' opinions are based on solid scientific foundations, including thorough physical inspection of the Sequoia DREs and security seals, and their beliefs are shared by members of the scientific community.

VII. FACTS RELATED TO THE TRIAL COURT'S POST MARCH 8, 2010 ORDER SUBJECT TO AND RELATED TO THIS APPEAL.

The trial court issued an opinion on February 1, 2010 and an order on March 8, 2010 with specific directives to the

Appellees to improve the security of DREs. The March 8, 2010 order contained specific deadlines by which the State had to implement security measures. The State missed every deadline, to the detriment of the Appellants. The trial court retained jurisdiction over this case until June 6, 2011, giving Appellants repeated extensions to implement their security measures. During that time, the trial court issued a series of orders and findings that are directly relevant to this appeal.

A. The Post Trial Certification Hearing For The Sequoia Advantage Was Not Adequate.

In her February 1, 2010 opinion, Judge Feinberg found that the Committee required by Title 19 (the "Title 19 Committee") to certify voting machines at "present composition . . . and most likely the composition in the past, failed to meet the requirement that two of the members be 'mechanical experts,'" and was thus inadequate and not in compliance with N.J.S.A. §19:48-2. (Gusciora, slip op. at 198 (Law Div. Feb. 1, 2010); Pa339.)

In accordance with her March 8, 2010 Order, the Title 19 Certification Committee conducted a Certification Hearing of the Sequoia Advantage DRE on April 28, 2010. That Certification was rife with error and was not sufficient for evaluating the State's DREs.

Shockingly, the Committee examined the Sequoia AVC Advantage 9.00G, and not the 9.00H. The AVC Advantage 9.00H is the most widely used voting machine in New Jersey. (4/28/10 Title 19 Hr'g at 35:20-21; Pa1399.) The 9.00G is used in only two counties in New Jersey. (4/28/10 Title 19 Hr'g at 35:15 to 36:11; Pa1399-1400.) Additionally, the April 28 hearing was exceedingly short, lasting 2 hours and 45 minutes. (See 4/28/10 Title 19 Hr'g Tr.; Pa1370.) The State's own witness said he requires several days to evaluate the voting machines. (Shamos Test., 3/23 Trial Tr. at 207:8-20.

Inexplicably, the computer scientists on the Committee did not examine a single line of source code or machine code, did not examine a single document describing the internal architecture of the AVC Advantage, and made only the most superficial physical inspection of the DRE. (8/30/10 Appel Cert. at ¶ 2; Pa1615.) The Committee also did not examine the AVC Advantage for known memory issues, a central issue to this litigation. (See generally 4/28/10 Title 19 Hr'g; Pa1370.) The Committee also did not did not examine the front panel of the voting machine, a known insecurity of the DRE, subject to the frontal attack devised by Dr. Johnston. (4/28/10 Title 19 Hr'g at 57:1-15; Pa1418.)

During the hearing, the Committee did not do an independent analysis of the DREs. The Committee recited the voting machine

requirements of N.J.S.A. 19:48-1 and 19:53A-3, and then asked a Sequoia employee whether the Sequoia AVC Advantage satisfies these requirements. (4/28/10 Title 19 Hr'g at 80:3 to 100:15; Pa1437-55.) Of course, the Sequoia employee stated that his product met New Jersey's statutory requirements.

Notably, the Committee tested the AVC Advantage only to the 1990 Voluntary Voting System Guidelines. (4/28/10 Title 19 Hr'g at 79:16-25; Pa1437.) At trial, Appellees' own witness, Mr. Terwilliger, testified that the 1990 standards did not involve examining software. (Terwilliger Test., 3/30 Trial Tr. at 21:8-17). Appellees' other expert concurred that the 1990 standards are completely useless for electronic voting machines. (Shamos Test., 3/23 Trial Tr. at 192:9 to 193:4) The Title 19 Committee did not impose a more rigorous standard of evaluation of the Sequoia AVC Advantage DRE it was examining and did not test the software in any way. (4/28/10 Title 19 Hr'g at 79:14-25; Pa1437.) Thus, its evaluation was the same poor quality as certifications that had occurred before the trial. Appellees' own expert, Dr. Shamos, described that certification process as "inadequate." (Shamos Test., 3/23 Trial Tr. at 188:4-17.)

On August 5, 2010, The Secretary of State issued a certification for the Sequoia AVC Advantage 9.00G and 9.00H. (Certification of Approval of Voting Equipment, Pa428). Even

though the Committee lacked any factual basis for its Certification.

The Appellants challenged that Certification, to no avail. The trial court found the post-trial certification for the Sequoia AVC Advantage DRE was satisfactory. (9/23 Hr'g Tr. at 77:9-10.)

B. The Appellants Unilaterally Gave Themselves An Open-Ended Extension to Implement Security Measures.

In its March 8, 2010 order, the trial court ordered the Appellees to assist counties in ensuring the integrity of the transmission of election data between municipal clerks and county clerks by July 7, 2010. Acting unilaterally, and without seeking court approval, the Appellees failed to meet that deadline and said that the State would not comply with the court's order until at least September 2011, fourteen months past the deadline. To date, there is no evidence that the State has even complied with this deadline.

As a result, the deadline for implementing the trial court's security measures, as ordered on March 8, 2010, is essentially open-ended. This leaves the Sequoia Advantage DREs as insecure as they were when this litigation started.

C. The Sequoia 9.00H Has Been Proven Unreliable In A Recent New Jersey Election.

On June 7, 2011, the Democratic primary election was held in Cumberland County. The Sequoia AVC Advantage used in District 3 attributed votes to the wrong candidates. (7/11/11 Certification of Lizbeth Hernandez, Zirkle v. Henry, No. CUM-L-000567-11; Pa1637-41.) In that election, Ernest and Cynthia Zirkle ran against Vivian and Mark Henry. Forty-three people voted and eighty-six votes were cast. (June 7, 2011 Official Election Results Report Tape; Pa1647-58.) According to the election results report generated by the DRE, Cynthia Zirkle received ten votes, Ernest Zirkle received nine votes, Vivian Henry received thirty-four votes and Mark Henry received thirty-three. (Id.)

After the June 7, 2011 election, several voters informed the Zirkles they had cast their votes for them and were confused how they lost. In total, twenty-eight registered voters signed affidavits certifying they had voted for the Zirkles. (See 9/1/11 Hr'g Tr., Zirkle v. Henry, No. CUM-L-000567-11, at 43:11-44:5; Pa1712-1713.) Appellants' counsel challenged the election.

The Cumberland County Board of Elections and the State Attorney General's Office admit the Sequoia Advantage DRE used in the election switched votes. (See 6/24/11 Ltr. from

Cumberland County Board of Elections; Pa1639; 7/6/2011 Ltr. from Assistant Attorney General George Cohen to Judge David Krell; Pa1635.) According to Lizbeth Hernandez, , an attorney for the State, the Administrator of the Cumberland County Board of Elections, the voting machine was programmed wrong. Nobody in the Cumberland County Board of Elections caught the programming error. (Id.) Not surprisingly, the Pre-LAT test that Judge Feinberg touted as a security measure (contrary to all evidence), did not reveal the error either. The DRE had no mechanism to catch the error. (Hernandez 6/5/11 Cert. ¶ 3; Pa1638.)

As a result of the DRE switching votes, the Zirkles, who should have won, lost the election. Similarly, the DRE showed the Henry's to be the victors, even though they received fewer votes than the Zirkles.

The Zirkles, represented by Appellants' counsel in this case, filed suit challenging both the election results and the DREs. Judge Krell ordered that the DRE that misattributed votes be impounded until Prof. Appel could evaluate it. The day before Prof. Appel was to evaluate it, the DRE was "scrubbed clean." This means that all evidence that would have helped Judge Krell understand why the DRE misattributed votes was erased. Judge Krell referred the matter to the State Attorney General's Office for criminal investigation. Greg Adomaitis,

Zirkles Win Fairfield Election; State Can't Confirm Investigation. *The News of Cumberland County*, Sept. 27, 2011, available at http://www.NJ.com/Cumberland/index.ssf/2011/09/Zirkles_win-Fairfield_election.html (last visited Oct. 12, 2011).

Judge Krell ordered a new election after it was abundantly clear that something very wrong happened with the Sequoia AVC Advantage DRE in Cumberland County. (9/1/11 Hr'g Tr. at 6:21 to 7:1, 14:1; Pa1694, 1698.) As is discussed in greater detail in Section VB of the "Legal Argument" Section of this Brief, Judge Krell found that many of Judge Feinberg's findings about the security and accuracy of the State's DREs were not correct, and were not in place in Cumberland County.

LEGAL ARGUMENT

The trial court's evaluation of this case contains errors that are purely legal, purely factual, and some that derive from a mixture of law and facts. As such, Appellants have structured our legal argument to address each type of error separately. In Section I, Appellants show that the trial court's legal conclusions are incorrect because she relied on inapplicable case law. This Court should exercise de novo review to cure the trial court's legal errors and find that the Sequoia Advantage DREs violate the New Jersey Constitution and Title 19. Manalapan Realty v. Township Committee, 140 N.J. 366, 378 (1995).

In Section II, Appellants demonstrate that the trial court erred in her legal analysis because she failed to take into account uncontroverted evidence presented at trial. This Court should exercise its authority and consider de novo the evidence presented to issue new findings that the State's DREs violate constitutional and statutory laws. State v. Harris, 181 N.J. 391, 415-16 (2004), cert. denied, 545 U.S. 1145 (2005); see also Pollack v. New Jersey Bell Telephone Co., 116 N.J.L. 28, 30 (N.J. Sup. 1935).

In Section III, Appellants show that some of the trial court's critical factual findings were completely unfounded and not based on any evidence. Appellants request that this Court

exercise its full appellate powers pursuant to State v. Johnson, 42 N.J. 146, 158 (1964), to review these facts de novo and issue new findings consistent with the evidence.

In Section IV, Appellants show how the trial court's approval of the Sequoia Advantage's post-trial certification process was unfounded, not based on any evidence, and runs afoul of Title 19. Appellants request that this Court exercise its full appellate powers under Johnson to issue new findings, and to overturn the recent certification.

In Section V, Appellants demonstrate how events that occurred after the trial court issued her Order on March 8, 2010, and her final Order on June 6, 2011, further show that the trial court's factual findings were wrong. Section V also demonstrates how security-related deadlines were ignored by Appellees. As a result, the State's 11,000 DREs are no safer than they were seven years ago when this litigation was initiated. Appellants ask this Court to take judicial notice of those events. Taken together, they show that the trial court's post-trial orders are not effective for securing the State's DREs.

Finally, in Section VI, Appellants request that this Court exercise original jurisdiction not only to overturn the trial court's judgment, but to order the State to replace the insecure Sequoia Advantage DREs with auditable voting machines. Only by

granting Appellants' prayer for relief can this Court restore the full and legally required protection to votes cast in the State of New Jersey.[11]

I. THIS COURT HAS THE AUTHORITY TO MAKE NEW FINDINGS OF LAW TO CORRECT THE TRIAL COURT'S MANY LEGAL CONCLUSIONS.

This Court is authorized, under the New Jersey Constitution as well as the New Jersey Court Rules, to "exercise such original jurisdiction as may be necessary to the complete determination of any cause on review." N.J. Const., art. VI, § V., ¶ 3; R. 2:10-5.

"When deciding a purely legal issue, [the standard of] review is de novo; [the reviewing Court] look[s] at the law with fresh eyes." Fair Share Hous. Ctr., Inc. v. New Jersey State League of Municipalities, 207 N.J. 489, 494 n. II 1 (2011). "A trial court's interpretation of the law and the legal consequences that flow from established facts are not entitled to any special deference [by the reviewing Court]." Manalapan Realty v. Township Committee, 140 N.J. 366, 378 (1995).

[11] According to VerifiedVoting.org, thirty-three states, and the District of Columbia, have enacted voter-verified paper record legislation or regulations, including: AK, AZ, CA, CT, HI, ID, IL, IA, MA, ME, MI, MN, MO, MT, NE, NV, NH, NM, NY, NC, ND, OH, OK, OR, RI, SD, UT, VT, WA, WI, WV, WI, WY. See State Election Equipment, VERIFIEDVOTING.ORG, http://www.verifiedvoting.org/verifier/ (last visited Oct. 10, 2011). New Jersey, while listed on the website as a state that requires a voter-verified paper ballot, does not currently comply with its statutory obligations.

Therefore, this Court owes no deference to the trial court's legal findings and has broad authority to make new findings of law in its review of the trial court's legal conclusions.

As will be discussed in this section, the trial court made many critical legal errors. The trial court applied irrelevant case law in analyzing Appellants' constitutional and statutory claims. She even applied the wrong level of scrutiny in evaluating the constitutional issues in this case.

Appellants ask this Court to use its broad scope of review to correct the trial court's myriad legal errors by reversing the trial court's findings and granting Appellants their requested relief.[12]

A. The Right To Vote Is A Fundamental Right. Included In The Right To Vote Is The Right To Have One's Vote Counted As Cast.

The right to vote is fundamental and is crucial to the effective operation of a democratic society. See In re Attorney General's "Directive on Exit Polling: Media & Non-Partisan Pub. Interest Groups", 200 N.J. 283, 302 (2009)("The right to vote is among the most prized of all rights in a democracy."); Bush v. Gore, 531 U.S. 98, 104 (2000); see also N.J. Const., art. I, ¶

[12] This Court should grant Appellants' requested relief, as opposed to a remand, because this case has been litigated for nearly eight years and any further delay would cause additional damage to New Jersey citizens' fundamental voting rights. This Court's authority to grant Appellants' requested relief will be discussed in Section VI of the "Legal Argument" of this brief.

2; U.S. Const., amend. XV, § 1; Macdougall v. Weichert, 144 N.J. 380, 422 (1996). "[It] has taken its place among our great values," and "is the citizen's sword and shield." Gangemi v. Rosengard, 44 N.J. 166, 170 (1965). As Chief Justice Weintraub noted in Gangemi, 44 N.J. at 170, quoting Wesberry v. Sanders, 376 U.S. 1, 17 (1964), "[o]ther rights, even the most basic, are illusory if the right to vote is undermined." "It is the keystone of a truly democratic society." Gangemi, 44 N.J at 170; see also Reynolds v. Sims, 377 U.S. 533, 562 (1964)("[T]he right to exercise the franchise in a free and unimpaired manner is preservative of other basic civil and political rights.").

The protections guaranteed by the right to vote extend beyond the "initial allocation of the franchise" and to the manner in which the voting process is exercised by the State. Bush, 531 U.S. at 104; Reynolds, 377 U.S. at 562. Just as the right to vote cannot be denied outright, neither can it be "destroyed by alteration of ballots, nor diluted by ballot-box stuffing." Reynolds, 377 U.S. at 555 (citations omitted). Moreover, it is "unquestionable that the right to have one's vote counted is as open to protection . . . as the right to put a ballot in a box." United States v. Mosley, 238 U.S. 383, 386 (1915).

"One source of [the right to vote's] fundamental nature lies in the equal weight accorded to each vote and the equal

dignity owed to each voter." Bush, 531 U.S. at 104. As the United States Supreme Court held in United States v. Classic, 313 U.S. 299, 315 (1941), "included within the right to [vote] . . . is the right of [] voters within a state to cast their ballots and have them counted." The New Jersey Supreme Court has similarly held that "[i]t is an unquestionable proposition that '[a] citizen's constitutional right to vote for the candidate of his or her choice necessarily includes the corollary right to have that vote counted at full value without dilution or discount.'" In re Contest of the November 8, 2005 General Election for Office of Mayor of the Tp. of Parsippany-Troy Hills, 192 N.J. 546, 578 (2007), quoting In re Gray-Sadler, 164 N.J. 468, 474 (2000). In other words, "one person, one vote." Reynolds, 377 U.S. at 558; see also Jackman v. Bodine, 43 N.J. 453, 461 (1964); 42 U.S.C.A. § 1973L(c)(1) ("The terms 'vote' or 'voting' shall include all action necessary to make a vote effective in any . . . election, including, but not limited to . . . casting a ballot, and having such ballot counted properly and included in the appropriate totals of votes cast.").

Appellants have shown that the DREs used throughout this State violate New Jersey citizens' right to have their vote counted as cast. New Jersey's DREs can be made to mis-record votes, and register votes for the wrong candidate, without

detection. (Appel Test., 1/29 Trial Tr. at 74:8-16.) When the DREs cheat, the voter's true intention is lost and cannot be retrieved. Because the DREs do not produce a voter-verified paper ballot, and are not otherwise auditable, voter intent can never be ascertained. Appellants have shown that there is ample opportunity to access the DREs and to make them cheat, and that the Appellees proposed security measures cannot protect against tampering. (Mahoney Test., 2/23 Trial Tr. at 109:1-6; Gentile Test., 2/23 Trial Tr. at 41:18-23, 44:3-5, 61:12-14; Johnston Test., 4/21 Trial Tr. at 20:15-24; 146:24-147:14; Appel Test., 1/28 Trial Tr. at 79:12-19.) Taken together, the evidence shows overwhelmingly that we have no idea whether the Appellees' DREs count votes as cast, as required by the New Jersey Constitution.

B. The Trial Court Fundamentally Erred In Determining What Level Of Scrutiny To Apply To Appellants' Constitutional Claims.

The trial court used irrelevant cases in finding that strict scrutiny should not be applied to Appellants' constitutional claims. When this Court reviews Appellants' claims using appropriate case law, it becomes clear that the Sequoia Advantage 9.00H DREs, used in eighteen of the State's twenty-one counties, is unconstitutional. Owing no deference to the trial court's legal conclusions, this Court should exercise its broad authority, Manalapan Realty, 140 N.J. at 378, to apply strict scrutiny to its analysis of Appellants' constitutional

claims. While Appellants believe that strict scrutiny is the appropriate methodology for this Court's analysis, New Jersey's voting machines are also constitutionally deficient under an intermediate scrutiny analysis.

Appellants have shown that New Jersey's computerized DREs can readily be made to ignore voters' intent. Prof. Appel demonstrated that the DREs can be made to mis-record votes, and attribute votes to the wrong candidate, without detection. (Appel Test., 1/29 Trial Tr. at 74:8-16.) Appellants' expert witnesses have shown their hacks are impossible to detect. (Shamos Test., 3/24 Trial Tr. at 64:13-15.) Thus, when DREs cheat, the voter's true intention is lost and cannot be retrieved. Because New Jersey DREs do not produce a voter-verified paper ballot, and are not otherwise auditable, voter intent can never be ascertained.

Appellants have shown through the testimony of Prof. Felten, Mr. Mahoney, Mr. Clayton, Mr. Giles and Ms. Gentile, that there is ample opportunity to access the DREs and to make them cheat. (Felten Test., 2/10 Trial Tr. at 27:18-21; Mahoney Test., 2/23 Trial Tr. at 108:20-25; Clayton Test, 3/3 Trial Tr. at 85:19 to 86:9; Giles Test., 3/3 Trial Tr. at 154:3-11; Gentile Test., 2/23 Trial Tr. at 48:17-24.) The DREs are left unattended for up to two weeks before and after an election, are transported by a third-party trucking company with no chain of

command, and are left in insecure warehouses. (Mahoney Test., 2/23 Trial Tr. at 109:1-6; Gentile Test., 2/23 Trial Tr. at 41:18-23, 44:3-5, 61:12-14.) Finally, Appellants have shown through the testimony of Dr. Johnston and Prof. Appel that Appellees' proposed security measures cannot protect against tampering. (Johnston Test., 4/21 Trial Tr. at 20:15-24, 146:24-147:14; Appel Test., 1/28 Trial Tr. at 79:12-19.)

Taken together, the evidence shows overwhelmingly that we have no idea whether the State's 11,000 computerized voting machines, which are used multiple times each year throughout the State, count votes as cast, as required by the New Jersey Constitution. Classic, 313 U.S. at 315; In re Gray-Sadler, 164 N.J. 468, 474 (2000). Therefore, the continued use of the Sequoia Advantage 9.00H DREs infringes upon New Jersey citizens' fundamental right to have their vote counted as cast. Gray-Sadler, 164 N.J. at 474.

1. Storer and Its Federal and State Progeny are Inapplicable Because They Deal with Situations Completely Different From Those Presented in This Case. Those Cases Deal with Challenges to State Regulations and Statutes as Burdens on Access to the Ballot.

The trial court fundamentally erred in its consideration and application of Storer v. Brown, 415 U.S. 724 (1974); Anderson v. Celebrezze, 460 U.S. 780 (1983); Burdick v. Takushi, 504 U.S. 428 (1992); and Timmons v. Twin Cities Area New Party,

520 U.S. 351 (1997) to the legal issues in this case. (Gusciora v. Christie, No. MER-L-2691-04 (Law Div. Feb. 1, 2010)(slip op. at 167-182; Pa319-25.) Storer and its progeny are facially inapplicable to Appellants' claims because Appellants do not challenge any regulation or statute as unconstitutional. Instead, Appellants claim that the Appellees violate New Jersey statutes and the New Jersey Constitution through the continual use of 11,000 paperless computer voting machines (DREs). As such, the trial court erred in considering and applying Storer and its progeny in its resolution of this matter.

In defining what level of scrutiny to apply to Appellants' constitutional claims, the trial court began its analysis by noting that, when faced with a constitutional challenge, a statute is presumed to be constitutional. Brown v. State, 356 N.J. Super. 71, 79-80 (App. Div. 2002). That may be the case. But, Brown is not at all related to this lawsuit because Appellants are not challenging any statute.

The trial court next cited to Yick Wo v. Hopkins, 118 U.S. 356 (1886), for the proposition that states are entitled to broad leeway in regulating elections. That also is true. But the holding in Yick Wo is broader. Yick Wo also held that State regulations may not operate to "subvert or injuriously restrain the right [to vote] itself." Id. at 371 (quoting Capen v.

Foster, 12 Pick. 485, 489 (1832)).[13] Yick Wo does not support the trial court's findings because, as Appellants will show, the Appellees' failure to comply with Title 19 and the New Jersey Constitution directly compromises the fundamental voting rights of New Jersey citizens.

Having laid a faulty foundation through the use of Brown and Yick Wo, the trial court next turned its analysis to Burdick. In finding that strict scrutiny was not appropriate in this case, the trial court relied on the test first enunciated in Burdick, 504 U.S. at 434, and later used in Storer and Timmons. (Gusciora, slip op. at 170 (Law Div. Feb. 1, 2010); Pa323-25.) However, the Burdick test is inapplicable here because it only applies in the context of § 1983 federal challenges to State statutes and regulations that allegedly burden access to the ballot.

Along these same lines, the New Jersey cases upon which the trial court relied used the Storer and Burdick analysis. Each of those cases, like Storer and Burdick, are facial challenges to statutes and regulations. See Wurtzel v. Falcey, 69 N.J. 401, 402 (1976)(plaintiff brought a declaratory judgment action challenging, on equal protection grounds, the minimum age

[13] The citation Capen v. Foster appears in the trial court's opinion. The proper case citation is Capen v. Foster, 29 Mass. 485, 489 (1832).

requirements for certain elective offices listed in the New Jersey Constitution); New Jersey Conservative Party, Inc. v. Farmer, 332 N.J. Super. 278, 282 (Ch. Div. 1999)(plaintiff political party challenged New Jersey statutory law, alleging that it unconstitutionally excluded them from preferred ballot positioning); Council of Alternative Political Parties v. State, Div. of Elections, 344 N.J. Super. 225, 231-32 (App. Div. 2001)(plaintiff challenged, on equal protection grounds, two statutes which precluded a registered voter from declaring party affiliation other than Democrat, Republican and Independent); Greenberg v. Kimmelman, 99 N.J. 552 (1985)(plaintiff challenged a New Jersey statute prohibiting certain individuals from employment at casinos); Hartman v. Covert, 303 N.J. Super. 326 (Law Div. 1997)(the court declared a New Jersey statute unconstitutional after the plaintiff brought an action alleging violations of that statute by the defendant). (Gusciora, slip op. at 170-71 (Law Div. Feb. 1, 2010); Pa323-25.)

In stark contrast to the claims in the federal and New Jersey cases cited by the trial court, Appellants have not filed a § 1983 claim and do not challenge any New Jersey statute or regulation. Appellants do not assert that Title 19 or any state regulation in any way inhibits access to the ballot.

To the contrary, Appellants believe Title 19 provides ample protection for voters. Indeed, Appellants have been litigating

this case for nearly eight years to enforce Title 19. Appellants argue that New Jersey's 11,000 paperless Sequoia Advantage DREs violate Title 19 and the New Jersey Constitution, which guarantees both the right to vote and the right to have one's vote counted, because the DREs can be easily manipulated to alter election results. See, supra, Section I.B.2. Therefore, Burdick and the Storer line of cases are wholly inapplicable to Appellants' present claims.

2. The Trial Court Erred in Not Applying Strict Scrutiny in Its Analysis of Appellants' Claims.

Given the evidence provided in this case on the insecurity of the paperless DREs used in every election, Appellants would prevail under either a strict scrutiny or an intermediate scrutiny standard. The trial court should have applied strict scrutiny in its analysis of Appellants' claims but failed to do so.

New Jersey courts grant a high level of protection to the right to vote, see Gangemi v. Berry, 25 N.J. 1, 12 (1957), and have consistently equated it with the requirement that the true intent of the voters be captured. See In re Gray-Sadler, 164 N.J. 468 (2000)(setting aside an election where write-in votes were not counted due to poor instructions at the polls, despite the voter's clear intentions); In re the Petition of Fifteen Registered Voters of the County of Sussex, 129 N.J. Super. 296

(App. Div. 1974)(write-in votes counted where voters used only a first initial or only the last name when identifying their selections), certif. denied, 65 N.J. 577 (1974). Naturally, voter intent cannot be appropriately captured if a vote is not counted. As the United States Supreme Court noted, the right to have one's vote counted is fundamental to the franchise, and any infringement of it "must be carefully and meticulously scrutinized." Reynolds, 377 U.S. at 558.

Courts have used strict scrutiny in cases where a state has acted, or failed to act, in such a way that the right to vote has been infringed. State v. Barcia, 228 N.J. Super. 267, 279-80 (Law Div. 1988), aff. by, 235 N.J. Super. 311 (App. Div. 1989) (citing San Antonio Independent School District v. Rodriguez, 411 U.S. 1, 16 (1973)("Whenever a state action infringes upon a constitutionally protected fundamental liberty, the court must undertake highly intensified or strict scrutiny of that action.")

It is clear that federal courts use strict scrutiny to analyze infringements of the right to have one's vote counted as cast. Reynolds, 377 U.S. at 558. It is equally clear that New Jersey courts consistently and fiercely protect the right to accurately record voter intent. See In re Gray-Sadler, 164 N.J. 468 (2000)(the Supreme Court ordered a special election after determining that write-in votes went uncounted as a result of

non-compliance with statutory requirements by election officials); see also Borough of Rocky Hill v. State, 420 N.J. Super. 365, 380-81 (Ch. Div. 2010)(plaintiff alleged, on Equal Protection grounds, that a statute mandating the elimination and merger of all non-operating school districts in New Jersey violated one person, one vote).

When manipulable voting machine technology is used (as is the case here), the intent of each citizen is potentially subverted every time a vote is cast. Appellants have presented uncontested evidence that the Sequoia Advantage 9.00H DREs can readily be made to ignore the intent of voters. The DREs can be made to mis-record votes, and register votes for the wrong candidate, without detection. When the DREs cheat, the voter's true intention is lost and cannot be retrieved. Because the DREs do not produce a voter-verified paper ballot, and are not otherwise auditable, voter intent cannot be ascertained.

In Stewart v. Blackwell, 444 F.3d 843 (6th Cir. 2006), vacated as moot, 473 F.3d 692 (6th Cir. 2007), a case which is analogous to the instant matter, the Sixth Circuit applied strict scrutiny where computerized, paperless voting machines used in several Ohio counties caused tens of thousands of votes to go uncounted.[14] The Sixth Circuit reasoned that the use of

[14] Although the decision was ultimately vacated as moot when the State of Ohio voluntarily abandoned all of the challenged voting

deficient voting technology, in an election in which citizens were entitled to vote, caused an infringement of those citizens' right to vote. Id. at 868-69.

Appellants have shown that there is ample opportunity to access the DREs and to make them cheat, and that the Appellees' proposed security measures cannot protect against tampering. As in Stewart, where thousands of votes went uncounted due to deficient technology, Appellants' evidence, taken in its totality, shows overwhelmingly that we have no idea whether the State's DREs count votes as cast, as required by the New Jersey Constitution. Therefore, use of the DREs infringes upon New Jersey citizens' fundamental right to have their votes counted as cast. In re Gray-Sadler, 164 N.J. 468, 474 (2000). As such, strict scrutiny is applicable. Stewart, 444 F.3d at 868-69.

Strict scrutiny requires this Court to determine whether the State's decision to continue to use the insecure DREs that can be made to cheat is "narrowly tailored to serve a compelling state interest," Moriarty v. Bradt, 177 N.J. 84, 103 (2003)(citing Washington v. Glucksberg, 521 U.S. 702, 720-21

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machines, 473 F.3d 692 (6th Cir. 2007), it has since been cited to, see, e.g., Paralyzed Veterans of Am. v. McPherson, 2008 U.S. Dist. LEXIS 69542 (N.D. Cal. Sept. 8, 2008), and followed, see, e.g., United States Student Ass'n Found. v. Land, 585 F. Supp. 2d 925 (E.D. Mich. 2008), stay denied by, 2008 U.S. Dist. LEXIS 87500 (E.D. Mich. 2008), motion granted by, stay denied by, 546 F.3d 373 (6th Cir. 2008), for various propositions of law.

(1997)), cert. denied, 540 U.S. 1177 (2004), and whether the use of the Sequoia Advantage 9.00H DREs was "the least restrictive means available to achieve that interest." In re Inquiry of Broadbelt, 146 N.J. 501, 518 (1996)(citing Barone v. Dpt. of Human Services, 107 N.J. 355, 365 (1987)), cert. denied, 520 U.S. 1118 (1997). Appellees have not asserted any objective that is being furthered by using DREs that can be made to cheat and that violate the mandate of the New Jersey Constitution that all votes be counted as cast. Nor have Appellees argued that the DREs are necessary to protect the integrity of the democratic process.

Moreover, the use of the constitutionally deficient DREs is not the least restrictive means of promoting Appellees' non-existent governmental interests. Appellants have consistently advocated for, and indeed New Jersey law requires a voter-verified paper ballot. This can take a number of different forms: (1) hand-counted paper ballots; (2) optical-scan ballots; or, (3) printed paper ballots in conjunction with computer-based DREs.[15] (Appel Test., 4/14 Trial Tr. at 30:16 to 31:4; Appel Report § 67.1, at 140; Pa671.) Each of these commercially available options would allow every voter's intent to be

[15] Appellants' argument for the use of these forms of voter-verified paper ballots will be discussed in greater detail infra.

recorded and would provide greater protection for voters' fundamental right to have their vote counted as cast. As such, continued use of the Sequoia Advantage DREs cannot survive a strict scrutiny analysis.

Even if this Court determines that strict scrutiny is not applicable, Appellants would still prevail under an intermediate scrutiny analysis. Intermediate scrutiny is appropriate when "a fundamental right is substantially affected in an indirect manner." Matthews v. Atlantic City, 84 N.J. 153, 167 (1980). As discussed above, Appellees' decision to continue to use DREs that can be made to cheat cannot guarantee voters the fundamental constitutional right to have their vote counted.

Intermediate scrutiny requires this Court to determine if the use of the DREs is "reasonably and suitably tailored to further legitimate governmental objectives." Id. at 169. As noted above, Appellees have not asserted any objective, nor have they argued that the DREs are necessary to protect the integrity of the democratic process. Therefore, Appellees cannot survive even intermediate scrutiny. As such, Appellants respectfully request that this Court reverse the trial court's judgment and grant Appellants' requested relief.

C. The Trial Court's Constitutional Analysis is Seriously Flawed. The Trial Court Relied on Out-Of-State Cases That Are Not Only Distinguishable and Irrelevant, But Inappropriately Perpetuate a Seriously Flawed Standard.

The trial court's finding that the Sequoia Advantage 9.00H DREs pose "no constitutional impediment to the election process" is legally incorrect. The trial court improperly relied on a series of federal and out-of-state cases in evaluating the Appellants' constitutional claims. All of those cases are distinguishable, and one case is so completely irrelevant, it is unclear why the court cited to it.

Five of the cases upon which the trial court relied involved legal challenges to state statutes specifically authorizing the use of paperless voting systems. See Wexler v. Anderson, 452 F.3d 1226 (11th Cir. 2006), cert. denied, 559 U.S. 1111 (2007); Weber v. Shelley, 347 F.3d 1101 (2003); Mills v. Shelby Cty. Election Comm'n., 218 S.W.3d 33 (Tenn. Ct. App. 2006), app. denied, 2006 Tenn. LEXIS 1184 (2006); Favorito v. Handel, 684 S.E.2d 257 (Ga. 2009); Soubirous v. Cty. of Riverside, 2006 Cal. App. Unpub. LEXIS 1218 (Cal. App. 2006); Pa1722. Several cases also involved similar challenges under the U.S. Constitution. See Wexler, supra, 452 F.3d 1226; Weber, supra, 347 F.3d 1101; Tex. Democratic Party v. Williams, 285 Fed. Appx. 194, 2008 U.S. App. LEXIS 16406 (5th Cir. 2008), cert. denied, 555 U.S. 1100 (2009); Pa1741. These cases are

irrelevant because they deal with situations that are the opposite of what we have in New Jersey. Here, our state laws do not authorize the use of paperless DREs; rather, our State laws require that all voting machines produce a voter-verified paper ballot.

Although the deadline for the implementation of New Jersey's voter-verified paper ballot law has been pushed back for fiscal reasons, this does not in any way lessen this Court's authority to enforce that right or to protect New Jersey citizens' fundamental right to vote. Tellingly, the New Jersey Legislature had the opportunity to revoke the voter-verified paper ballot law. Through its refusal to do so, the Legislature demonstrated the importance that it places on the law, and the need to have verifiable elections in New Jersey.

Furthermore, as shown in the chart below, at least four of the cases approving paperless voting systems relied upon by the trial court have since been superseded by legislatively-created paper-based systems. See Schade v. Maryland Bd. of Elections, 401 Md. 1 (2007); Weber, 347 F.3d at 1101; Soubirous, 2006 Cal. App. Unpub. LEXIS 1218 (Cal. App. 2006); Pa1722; Mills, 218 S.W.3d 33 (Tenn. Ct. App. 2006).

Table 1				
State	Case	VVPB Statute/Law Overruling Case Law	Date Enacted	Text
FL	Wexler v. Lepore, 878 So.2d 1276 (Fla. Dist. Ct. App. 4th Dist. 2004), certif. denied, 888 So.2d 625 (Fla. 2004).	FL Statutes §§101.56075/Chapter 2007-30 SL 2007.	5/21/2007 (effective July 1, 2008)	requiring all voting to be by Marksense (also called optical scan technology)
CA	Weber v. Shelley, 347 F.3d 1101 (9th Cir. 2003). Soubirous v. Cty. of Riverside, 2006 Cal. App. Unpub. LEXIS 1218 (Cal. App. 2006); Pa1722.	Cal. Election Code §§ 19250/19251/Chapter 814, Statutes of 2004.	9/27/2004 (effective January 1, 2005)	requiring an accessible voter verified paper audit trail
TN	Mills v. Shelby Cty. Election Comm'n, 218 S.W. 3d 33 (Tenn. Ct. App. 2006), app. denied, 2006 Tenn. LEXIS 1184 (2006).	Tenn. Code Ann. 2-1-104, 2-20-101/Acts 2008, ch. 1108.	6/5/2008	requiring optical scan voter-verified paper ballots
MD	Schade v. Maryland State Bd. Of Elections, 401 Md. 1 (2007).	Md. Code Ann., Certification of voting systems, §9-102.	5/17/2007 (effective for elections after January 1, 2010)	provide a voter-verifiable paper record

Below, Appellants discuss in greater detail how the cases cited by the trial court are irrelevant to this litigation. Although the trial court relied most heavily on Schade v.

Maryland, 401 Md. 1 (2007), Appellants will distinguish that case last. The trial court's analysis of that case was so completely problematic that a separate discussion is needed to fully address the court's many errors.

1. In Her Constitutional Analysis, the Trial Court Relied on Out-Of-State Cases that Are Inapplicable to this Lawsuit.

In making her constitutional determinations, the court relied on several inapplicable cases in which plaintiffs challenged the use of paperless voting systems in states that did not have express statutory requirements for paper ballots.

Oddly, the trial court failed to discuss cases that found that DREs violated voting rights. In Stewart v. Blackwell, 444 F.3d 843 (6th Cir. 2006), vacated as moot, 473 F.3d 692 (6th Cir. 2007), the court overturned a district court ruling and held that the use of outdated voting technologies in Ohio violated the U.S. Constitution. Stewart, 444 F.3d at 846. The court found that "case law, statutory definitions, and common sense indicate that the 'right to vote' is infringed . . . by the use of . . . deficient technologies" Id. at 869. The case was ultimately dismissed on grounds of mootness, but only because Ohio state officials decided to abandon the state´s electronic voting machines. Stewart v. Blackwell, 473 F.3d 692 (6th Cir. 2007).

Likewise, the trial court ignored Banfield v. Cortes, 922 A.2d 36, 40-41 (Pa. Commw. Ct. 2007), a case almost identical to this case. In Banfield, the Pennsylvania Commonwealth Court denied a motion to dismiss a lawsuit challenging (on both statutory and constitutional grounds) various DREs certified by the Pennsylvania Secretary of State (including the Sequoia AVC Edge and AVC Advantage). The Court found that mandamus relief, specifically de-certification of the DREs, is appropriate where the certification process was inadequate to test the DREs reliability and accuracy. In denying the motion to dismiss, the Banfield court found that "defects and security flaws" of paperless DREs may violate voters' constitutional right to vote. Id. at 49.

These cases recognize that because of their vulnerability to tampering, paperless DREs are constitutionally infirm. Further, the Pennsylvania case recognizes that anemic certification standards are sufficient to call the constitutional integrity of a voting system into question. Banfield, 922 A.2d at 50.

Rather than rely on relevant cases for her constitutional analysis, the trial court cited only to inappropriate cases that upheld electronic voting machines. The court cited to two California cases, Weber v. Shelley, 347 F.3d 1101 (9th Cir. 2003), and Soubirous v. Cty. of Riverside, 2006 Cal. App. Unpub.

LEXIS 1218 (Cal. App. 2006); Pa1722, which are both distinguishable. Weber v. Shelley, 347 F.3d 1101 (9th Cir. 2003), is a federal lawsuit filed pursuant to 42 U.S.C.A. § 1983 that challenged the constitutionality of paperless touchscreen voting systems used in Riverside County, California. The Weber court upheld the use of the Sequoia AVC Edge and declined to find that paperless voting machines severely restricted the right to vote under the U.S. Constitution. Weber, 347 F.3d at 1107. The court held that because "[n]othing in the Constitution" forbade the legislature's choice of balloting systems and because its choice was "reasonable and neutral," the court had no authority to second-guess the California legislature. Id.

In Soubirous v. Cty. of Riverside, 2006 Cal. App. Unpub. LEXIS 1218, at 57-58 (2006); Pa1736-37, an unpublished case, plaintiffs alleged that the Sequoia AVC Edge was in violation of the California statute requiring that a voting system be "'capable' of printing the paper versions or representations of the ballots." In that case, the Secretary of State of California at the time interpreted the word "capable" in the statute as merely meaning that the DRE in question could, in fact, print paper ballots. Id. at 58; Pa1736-37. The Secretary did not view actually printing ballots as statutorily required. Id. However, by the time the Court of Appeals of California

ruled on the case, a new Secretary of State assumed office, and California passed legislation requiring that all voting machines be required to leave paper trails that could be checked by election officials. The California court therefore found the "changes in the law" to be intervening events that rendered the plaintiffs' claims moot. Id. at 59-60; Pa1737.

Weber and Soubirous are inapplicable for several reasons. First, federal constitutional rights were at issue in Weber. The federal court did not believe it was appropriate to tell California counties what voting machines to use. The present case, in contrast, is a state law case that asks the judiciary to enforce New Jersey legislation that expressly requires the State to implement procedures that will make the State's 11,000 paperless DREs auditable.

Second, events subsequent to the Weber decision undermined the factual basis upon which Weber and Soubirous were decided. Shortly after Weber was decided, the State of California decertified the Sequoia AVC Edge due to serious, endemic flaws discovered in the voting machines by computer security experts hired by the State.[16] California had also passed sweeping

[16] In 2007, California Secretary of State Debra Bowen ordered a "top-to-bottom review" of the state's voting machines. As a result of the study, Secretary Bowen mandated several security improvements. See California Secretary of State Debra Bowen, Top-to-Bottom Review, http://www.sos.ca.gov/voting-systems/oversight/top-to-bottom-review.htm.

legislation that required all electronic voting machines used in California to produce printed records of votes cast on each respective machine.[17]

The trial court also cited to Favorito v. Handel, 684 S.E. 2d 257 (Ga. 2009), a case in which plaintiffs challenged a law passed by the Georgia legislature that explicitly adopted touchscreen voting machines. The court in Favorito declined to find an absolute requirement, absent statutory language to that effect, for paper ballots to be used in every voting system in Georgia. Id. at 262-63. This is distinctly different from the present case. In New Jersey, under N.J.S.A. 19:48-1 and 19:61-9, the state legislature has, in fact, explicitly adopted such language, requiring the use of voter-verifiable paper records for post-election audits.

The trial court also relied on a state case from Tennessee, Mills v. Shelby Cty. Election Comm'n., 218 S.W.3d 33 (Tenn. App. Ct. 2006), app. denied, 2006 Tenn. LEXIS 1184 (2006), in which the plaintiff challenged the use of paperless voting machines under the Tennessee Constitution. The appellate court in Mills ruled on two issues that are not in question in the present case: whether the plaintiff had standing and a valid cause of action. These two issues have already been settled in the

[17] Cal. Elections Code § 19250(c).

present case by this Court, when this Court reinstated the case after Judge Feinberg dismissed it in 2005 on the same grounds as the Mills court. The trial court, in relying on Mills, completely and inappropriately ignored the history of this case embodied by this Court's 2005 ruling.

The trial court also cited to Wexler v. Anderson, 452 F.3d 1226 (11th Cir. 2006), cert. denied, 559 U.S. 1111 (2007), a federal case from Florida in which plaintiffs challenged the use of touchscreen voting systems that, unlike other voting systems in the state (i.e. optical scan), required a different recount procedure, thereby violating equal protection and due process rights under the U.S. Constitution.[18] Wexler, 452 F.3d at 1231. As such, the issue before the Wexler court was whether Florida's different recount procedures violated voters' rights. Id.

By contrast, Appellants here are not pitting one type of voting system endorsed by state statute against another. New Jersey law requires the universal use of voter-verified paper ballots, the very relief sought by Appellants. N.J.S.A. 19:48-2. Appellants are challenging the failure to implement that

[18] A state lawsuit challenging the paperless feature of the voting system was filed earlier by the Wexler plaintiff but was dismissed because the plaintiff had "failed to state a cause of action . . . because 'the Florida statutory scheme does not clearly require a voter verified paper ballot.'" Wexler, 452 F.3d at 1230.

requirement, and the continued use of the insecure Sequoia AVC Advantage 9.00H.

The trial court cited to another federal case, Tex. Democratic Party v. Williams, 285 Fed. Appx. 194 (5th Cir. 2008), cert. denied, 2009 LEXIS 475 (U.S. 2009); Pa1741, an unpublished opinion from the Fifth Circuit Court of Appeals that rejected federal claims challenging the use of paperless DREs under the Due Process and Equal Protection Clauses of the U.S. Constitution. That case is inapplicable here where Appellants are asserting claims under New Jersey statutory law and the New Jersey Constitution, and are not challenging any state laws under the federal constitution.

Additionally, and inexplicably, the trial court cited to Ford v. Cty. of Carlisle, 361 S.W.2d 757 (Ky. App. 1962), a case which is totally irrelevant to this litigation. In that case, the plaintiff challenged the use of voting machines that did not have a curtain to protect voter privacy. Kentucky state laws did not specifically require a curtain. Ford, 361 S.W.2d at 759. Needless to say, this issue differs greatly from that in the instant case, where Appellants are challenging the use of voting machines without paper trails where state law explicitly requires paper trails.

In sum, the trial court's constitutional analysis is seriously flawed. She relied on a series of cases that

challenged specific statutes authorizing the use of paperless DREs, as well as other legally and factually distinguishable cases, including one that is completely irrelevant to Appellants' claims. She also failed to recognize that the DRE cases that endorse paperless voting machines have since been superseded by legislation requiring paper-based auditable voting systems.

2. The Trial Court's Reliance on Schade v. Maryland Is Legally Erroneous on Many Levels.

A theme running through many of the cases upon which the trial court relied is that no voting system is perfect. That is the thrust of the main case upon which the court relied in finding that New Jersey's DREs are constitutionally sound, Schade v. Maryland Bd. of Elections, 401 Md. 1 (2007).

In Schade, plaintiffs were registered voters and political candidates who sought injunctive relief against the State of Maryland's decision to use Diebold DRE voting machines, citing vulnerabilities in the security and accuracy of the DREs. Id. at 5. In the alternative, plaintiffs also requested the addition of a voter-verified paper audit trail. Id. On appeal, the court denied the plaintiffs' requests and found that the State had acted reasonably in implementing the Diebold DREs, as the State Board had "broad discretion to weigh various factors and ultimately decide on a system." Schade, 401 Md. at 38-39.

The trial court here relied so heavily on Schade that she copied language from Schade directly into her opinion. Notably, the expert witness for the State of Maryland in that case, Dr. Shamos, also happened to be the same expert witness who testified on behalf of the State of New Jersey in the present case. Id. at 34-36. The trial court even noted that Dr. Shamos's testimonies in Schade and in the present case were "nearly identical." (Gusciora, slip op. at 186 (Law Div. Feb. 1, 2010); Pa327.)

That is precisely why the trial court's borrowing so heavily from Schade was legally improper. The trial court failed to recognize the difference in scope of Dr. Shamos's testimony in Schade from that of his testimony in this case. Dr. Shamos's testimony was severely limited in this case (by the trial court herself) because Dr. Shamos failed to examine or conduct any experiments on New Jersey's DREs. (Shamos Test., 3/24 Trial Tr. at 102:21 to 103:15.) For that reason, the trial court held that Dr. Shamos could not offer testimony on the security and reliability of New Jersey's DREs—the critical legal issues in this case. (Shamos Test., 1/27 Trial Tr. at 37:20-38:12.) Dr. Shamos was only allowed to comment on the methodology used by Appellants' expert Prof. Appel. Id.

If one reads the trial court's opinion carefully, she discussed Dr. Shamos's testimony not from this case but from

Schade. She gives Dr. Shamos's testimony in Schade tremendous credence, rather than looking closely at the evidence presented in this case.

Appellants' experts spent thirty days, working around the clock, and produced a detailed expert report discussing the many ways (and the ease with which) New Jersey's 11,000 Sequoia Advantage DREs can be hacked. (Appel Test., 2/5 Trial Tr. at 11:11 to 12:8; Appel Report, Aug. 29, 2008, § 1.3 at 7; Ex. P-2; Pa538; Appel Test., 1/27 Trial Tr. at 118:20-24). In contrast, Dr. Shamos presented no competing report. Thus, the only evidence before the trial court in this case about the security and reliability of New Jersey's DREs (the core legal issues in this case), was that offered by the Appellants' expert witnesses. That evidence, as discussed throughout this brief, can only be interpreted as showing that the State's DREs violate constitutional and statutory law.

For that reason, the court's borrowing from Schade was legally improper. It does not appear that Dr. Shamos's testimony was in any way restricted in Schade, as it was in this case. Furthermore, it appears that both Dr. Shamos and the plaintiffs' expert witness in Schade never actually examined Maryland's DREs. Schade, 401 Md. at 10, 22. Thus, unlike here, the Schade experts were offering their testimony based on general theoretical terms and broad scientific principles of computer

science, rather than on the results of scientific experimentation.

Dr. Shamos is the only computer scientist who believes that paperless DREs are superior to paper-based auditable systems. (Shamos Test., 3/23 Trial Tr. at 70:4-16; Shamos Test., 3/24 Trial Tr. at 83:8 to 84:17, 109:20 to 113:7.) Indeed, he has earned hundreds of thousands of dollars testifying on behalf of states in support of paperless systems. (Shamos Test., 3/24 Trial Tr. at 92:13-14.) Because he cannot support his position with hard science, he resorts to trying to denigrate the work of serious scientists by portraying them as out of touch academics who are not grounded in reality. The term he has tossed around in multiple cases, including Schade, and the case before this Court, is that scientists who point out the insecurities of computerized DREs are seeking to apply a "perfection" standard, rather than a "reasonableness" standard.

What those terms mean is unclear, as Dr. Shamos did not define those standards. They are not standards that exist in New Jersey law. Nonetheless, the trial court latched on to those phrases and adopted them as a constitutional standard for use in this case.

Without citing to Prof. Appel's report or testimony, the trial court accused Prof. Appel of espousing a "perfection" standard. The trial court then stated that this "perfection"

standard is "not consistent with the standards and methodology used in the trade, federal guidelines, or statute." (Gusciora, slip op. at 168 (Law Div. Feb. 1, 2010); Pa309.) However, the trial court never identified the legal standards, methodologies, guidelines, or statutes, to which she was referring, and never made clear in what respect Prof. Appel's testimony deviated from those standards.

What is most troubling in the trial court's wholesale adoption of Schade is that the trial court failed to take into account that Dr. Shamos's conclusions that paperless DREs were superior to auditable DREs, as adopted by the Schade court, were in clear error. (Appellants pointed this out to the court in their post-trial submissions in both text form and in the form of a chart, provided to this court in Section IC of the "Legal Argument" Section of this Brief.)

In the election immediately following the decision in Schade, the paperless DREs endorsed by the Schade court massively malfunctioned, due in large part to the very bugs cited by the plaintiffs' experts in Schade.[19] Subsequently, the State of Maryland pursued a claim for $8.5 million in

[19] Diebold Election Systems, after withering press coverage, has changed its name to Premier Election Solutions. Press Release, Premier Election Solutions, Inc., Diebold Election Systems to Become Premier Election Solutions (Aug. 16, 2007) (on file with author).

remediation costs against the DRE manufacturer to fix the damage caused by the company's defective voting machines.[20] Most notably, the State of Maryland also abandoned the defective paperless DREs at issue in Schade, by adopting auditable voting machines that produce paper ballots.[21]

Thus, contrary to the assertion that the defective Diebold DREs were acceptable under a "reasonableness" standard and could only be rejected under a "perfection" standard, as the Schade court reasoned, the Diebold DREs were hopelessly defective by any standard. In the aftermath of the 2006 electoral debacle, the Maryland House of Delegates voted unanimously to scrap the Diebold DREs and adopt optical-scan systems.[22]

In short, events immediately subsequent to the decision of the Schade case make it clear that Dr. Shamos's analysis was poor science, and that the analysis by the Schade plaintiffs' experts was correct. Judge Feinberg's wholesale adoption of

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[20] Laura Smitherman, Md. Files Claim to Recover Voting Machine Expenses, *Baltimore Sun* (Dec. 25, 2008).

[21] Md. Code Ann., Certification of voting systems, §9-102. While the first bill introduced to achieve this result did not clear the Senate, both chambers of Maryland's legislature subsequently passed it, and Governor O'Malley signed the ban into law in 2009. 2007 Bill Tracking MD S.B. 392.

[22] Id. In their post-trial briefs, Appellants pointed out that Schade's findings were no longer valid. The trial court ignored their discussion.

Schade in evaluating the constitutionality of the Sequoia AVC Advantage 9.00H DRE is thus a reversible legal error.

3. Contrary To The Trial Court's Findings, Appellants And Their Expert Witnesses Never Espoused A "Perfection" Standard.

Prof. Appel's scientific conclusions are based on nearly universal consensus among computer scientists and computer security experts as to proper programming practices, user interface design, prudent principles of computer security, and best practices in security auditing.[23]

In her constitutional analysis, the trial court stated that, to Prof. Appel, "any security vulnerability whatsoever renders the [voting] system unacceptable." (Gusciora, slip op. at 162 (Law Div. Feb. 1, 2010); Pa243.) The trial court did not cite any testimony in which Prof. Appel makes this claim, as there is not any. To the contrary, Prof. Appel's expert report and testimony explicitly reject the conclusion the court claims he made.

Prof. Appel was absolutely crystal clear that any electronic voting system, that is to say, one containing a computer, contains flaws:

[23] Plaintiffs say "nearly unanimous" because Dr. Shamos and only one other computer scientist, Dr. Brit Williams, are the only computer scientists who believe that voting machines with no independent audit mechanism are, somehow, more secure than those which have independent audit mechanisms. (Shamos Test., 3/24 Trial Tr. at 84:1-2.)

> THE COURT: Is it true that any computer system has bugs?
>
> THE WITNESS: Mostly. There are some computer systems that are small and simple and in which enormous effort goes into their review and validation, and in principle, it's possible. But any computer system of comparable complexity to the AVC Advantage and developed with comparable methods will have bugs.

(Appel Test., 2/4 Trial Tr. at 38:13-20.) It is precisely because Prof. Appel recognizes that every electronic voting system has flaws that he emphasizes the need for an independent, auditable record to ensure accuracy. A hypothetical "perfect" voting machine, impervious to tampering, would need no safeguards at all.

Additionally, the nature of Prof. Appel's scientific inquiry is completely inconsistent with a "perfection" standard. Had Prof. Appel applied such a standard, he would simply have needed to find one single flaw in the AVC Advantage and stopped there. Having proven the system not to be perfect, the "perfection" standard would prohibit the continued use of the system. Furthermore, with the myriad of flaws in the Sequoia AVC Advantage, finding a single one would have taken only minutes, and Prof. Appel's report would have consisted of only a single page of text. This was, of course, not the case. Instead, Prof. Appel's report was 155 pages and contained a host of severe security flaws in the system.

As the table of contents to his highly detailed and informative expert report shows, Prof. Appel uncovered many, many serious security flaws in the Sequoia AVC Advantage 9.00H DRE. (Appel Report, Ex. P-2; Pa532.) These flaws would allow a person with the equivalent of a bachelor's degree in computer science to hack the voting machine to steal votes indefinitely.[24] (Appel Test., 1/27 Trial Tr. at 77:14-20.)

Prof. Appel analyzed the source code of the firmware running in the AVC Advantage and found many troubling deficiencies. (Appel Report §§ 51-55, 106-114; Ex. P-2; Pa637-45.) Prof. Appel also analyzed the deficient user interface of the AVC Advantage, and his report details a number of flaws that would allow a corrupt poll worker or other person to steal votes or disenfranchise voters. (Appel Report, §§ 28-38, 75-87; Ex. P-2; Pa606-18; Appel Test., 1/29 Trial Tr. at 165:22 to 169:10; Appel Report, § 56.1, at 115; Pa646; see generally Appel Report, § III, at 75-87; Ex. P-2; Pa606-18.)

[24] Additionally, by the use of reverse-engineering, a routine industry practice, an attacker can examine a piece of computer hardware or a computer program, and turn its machine-readable code back into human-readable "source code" for analysis. This takes an undergraduate level of skill and a reasonable amount of time. (Appel Report, § 11, 38-44; Ex. P-2; Pa570-76.) The significance of this is that an attacker need not have the source code to attack the DRE, as Prof. Appel did, but could get source code through reverse engineering. (Id.)

Prof. Appel also recommended the precinct-count optical scan systems used in the vast majority of states as being superior to the paperless DREs which most states have abandoned, stating: "The user-interface of optical-scan ballots is simple and intuitive. That is not to say it is perfect[.]" (Appel Report, § 67.11, 142; Ex. P-2; Pa673.)

Additionally, Prof. Appel demonstrated his hack of the voting machine, on videotape and in court, by replacing the Program ROM, in six minutes and fifty-four seconds. (Appel Report, §§ 4-6, 16-23; Ex. P-2; Pa548-555; DVD 4 Tape 4, at 4:28 to 11:22; Ex. P-6; Pa731.) In this hack, Prof. Appel broke into the AVC Advantage in less than fifteen seconds. (Appel Test., 1/28 Trial Tr. at 83:18 to 84:10; DVD 4 Tape 5, at 5:58 to 8:19; Ex. P-6; Pa731.) Prof. Appel then replaced the Program ROM with a fraudulent ROM chip containing vote-stealing software, and returned it to operation in only seven minutes. (DVD 4 Tape 4, at 4:28 to 11:22; Ex. P-6; Pa731.) Prof. Appel demonstrated that the voting machine's "pre-LAT testing" mode would not detect the fraudulent firmware. (Id.) All copies of the legitimate election results would be permanently destroyed, leaving only the fraudulent results. (Id.)

Prof. Appel also found the following:

- The firmware does not authenticate vote data, rendering it vulnerable to tampering. (Appel Report § 39, 89-90; Ex. P-2; Pa619.)

- Sequoia does not keep track of what software they install on their DREs for use in the field, which makes detection of fraudulent firmware difficult. (Appel Report §§ 54-55, 111-14; Ex. P-2; Pa642-45.)

- The source code contains multiple errors and flaws, such as "buffer overflows," which can enable either error or fraud. (Appel Report, § 51, 107-08; Ex. P-2; Pa637-39.)

- The examination of the AVC Advantage by Wyle Laboratories failed to detect any of these flaws, as Wyle does not examine firmware in any depth. (Appel Report, § 52, 108-09; Ex. P-2 Pa632-41.)

- Sequoia claims not even to be in possession of the source code of some software components running on the AVC Advantage, meaning that neither Sequoia nor anyone else has any way at all to know whether it is or is not running tainted firmware. (Appel Report, § 54.12, 114; Ex. P-2; Pa645.)

One of the source code bugs Prof. Appel discussed and testified about at trial is the so-called "option switch bug,"[25] which is triggered when a poll worker accidentally or deliberately presses an incorrect button. This source code bug

[25] The impact of the option switch bug is that the voter is denied the opportunity to vote for the candidates of the voter's party. (Appel Report, § 56.1, 115; Ex. P-2; Pa646.) This violates New Jersey law. N.J.S.A. § 19:48-1a(h). Additionally, the voter is permitted to vote in the opposite party's primary. (Appel Report, § 56.1, 115; Ex. P-2; Pa646.) This, as well, violates New Jersey law. N.J.S.A. § 19:48-1a(h).

disenfranchised dozens of voters during the 2008 Presidential primary. (Appel Report §§ 56-58, 115-28; Ex. P-2; Pa646-59.)

In sum, Prof. Appel's conclusions were based on a scientific analysis of the AVC Advantage 9.00H DRE and commonly accepted scientific opinion as to the merits of different types of voting machines. Appellees, on the other hand, presented no competing science to challenge Prof. Appel's scientific conclusions, instead choosing to denigrate science itself with empty rhetoric and mere gainsaying.

4. In Her Constitutional Analysis, the Trial Court Improperly Rejected Prof. Appel's Opinion as to Accuracy, Despite State Law Requiring a More Stringent Standard.

The trial court incorrectly dismissed Prof. Appel's assertion that the "acceptable rate of error for a voting machine should be well under one percent." (Gusciora, slip op. at 69 (Law Div. Feb. 1, 2010); Pa210.) The court was wrong. What the court called Prof. Appel's "perfection" standard is, in fact, the law in the State of New Jersey.

In 2008, the New Jersey legislature approved N.J.S.A. § 19:61-9, in order to ensure the accuracy of elections. This law requires that after every election, an "independent, professional audit team" recount a statistically valid sample of paper ballots, that is to say, one from which scientifically valid inferences may be drawn. N.J.S.A. § 19:61-9.

The statute further requires that the recount of paper ballots must confirm "with at least 99% statistical power that for each federal, gubernatorial or other statewide election held in the State, a 100% manual recount" would not alter the outcome. Id. It is mathematical fact that in a close election, an error rate considerably less than 1% could be outcome-determinative, and therefore, the state legislature has clearly required a higher degree of accuracy.[26]

Therefore, Prof. Appel's standards do not represent merely his personal opinion, but have effectively been adopted by New Jersey's legislature. This discussion of N.J.S.A. § 19:61-9 was briefed extensively by Appellants. However, the trial court's opinion is utterly devoid of any analysis of this statute. The trial court erred as a matter of law in disregarding the plain language of N.J.S.A. § 19:61-9, which concurs with (and even exceeds) Prof. Appel's recommendations as to reasonable accuracy for a voting machine.

[26] The Department of the Public Advocate issued a report on the number of extremely close elections in New Jersey. For example, there have been "51 New Jersey elections in the last two years where the margin of victory was less than one percent, meaning that just a few additional votes for one candidate or one side of a public question would have changed the result." New Jersey Department of the Public Advocate, Close Elections in New Jersey and Their Significance for the Behavior of Eligible Voters and Election Officials, http://www.state.nj.us/publicadvocate/public/pdf/close%20elections%20article%20v6.pdf.

This Court should use its authority to find that the State's paperless Sequoia AVC Advantage 9.00H DREs violated the New Jersey Constitution. By any standard, voting machines that can be hacked readily do not and cannot guarantee that every vote cast is counted accurately. As such, they violate the New Jersey Constitution and Title 19, both of which require that votes be counted accurately.

D. The Trial Court Fundamentally Erred in Its Analysis of Appellants' Equal Protection Claims By Misapplying the Greenberg Test.

1. The Sequoia Advantage DREs' Lack of a Voter-Verified Paper Ballot Violates the Right to Equal Protection Guaranteed by the New Jersey Constitution.

The Sequoia Advantage DREs' lack of a voter-verified paper ballot violates the right to equal protection guaranteed by the New Jersey Constitution. Article 1, Paragraph 1 of the New Jersey Constitution protects against "the unequal treatment of those who should be treated alike." Greenberg v. Kimmelman, 99 N.J. 552, 568 (1985). Furthermore, "[o]ur State Constitution[in comparison to the federal Constitution] . . . provide[s] analogous or superior protections to our citizens." Peper v. Princeton Univ. Board of Trustees, 77 N.J. 55, 79 (1978).

Votes cast on DREs do not produce tangible evidence of voter intent, and therefore cannot be recounted like paper ballots or ballot cards. As such, in the event of a recount,

the minority group of voters who did not vote on a DRE will determine the outcome of an election, as those are the only votes that can be verified independently. Voters using DREs will be forced to rely on summaries of encoded data from unauditable computers that are prone to manipulation and error.

In sharp contrast, all New Jersey citizens who vote by absentee, emergency, or provisional ballots are guaranteed to have their votes counted in the event of a recount, even if they reside in counties that are using DREs. Joanne Rajoppi testified that, in the event of a recount, it is the emergency ballots that are recounted until a winner is declared. (Rajoppi Test., 2/26 Trial Tr. at 93:6-11.)

The inability to confirm the intent of DRE voters in the event of a recount, fraud or error in computation of DRE vote totals exposes voters to a significant risk of disenfranchisement not shared by other voters. This inequality concerning the protection of a fundamental right violates the equal protection rights of DRE voters under the New Jersey Constitution.

2. The Trial Court Erred in Its Analysis of Appellants' Equal Protection Claims by Misapplying the Greenberg Test.

In analyzing Appellants' Equal Protection claims, the trial court noted that:

> [E]ven if it were to analyze this case against a strict scrutiny standard under Greenberg, 99 N.J. at 552, as urged by plaintiffs, the defendants still pass this test, as any interference with voters' rights in this State is indirect, and not a substantial or intentional consequence of the use of the AVC system.

(Gusciora, slip op. at 197 (Law Div. Feb. 1, 2010); Pa338.) The trial court's analysis is incorrect. This Court should exercise its broad authority, Manalapan Realty, 140 N.J. at 378, to appropriately apply the Greenberg test to Appellants' Equal Protection claims.

Greenberg did not articulate a strict scrutiny standard applicable to equal protection claims under the New Jersey Constitution. The Court in Greenberg created an "independent analysis" applicable to claims arising under article 1, paragraph 1 of the New Jersey Constitution. Greenberg, 99 N.J. at 567. Having rejected the "two-tiered equal protection analysis" applied to federal equal protection claims, in Greenberg the Supreme Court of New Jersey adopted a "balancing test" under which it considers "the nature of the affected right, the extent to which the governmental restriction intrudes upon it, and the public need for the restriction." Id.

The appropriate application of Greenberg's balancing test would have required consideration of the nature of the right to vote, the extent to which the Sequoia Advantage system intrudes

upon the right to vote, and the public need for the Sequoia Advantage system. The right to vote has been characterized by the Supreme Court of New Jersey as "the keystone of a democratic society . . . [o]ther rights, even the most basic, are illusory if the right to vote is undermined." Gangemi v. Rosengard, 44 N.J. 166, 170 (1965) (quoting Wesberry v. Sanders, 376 U.S. 1, 17 (1964)). Although the trial court pays lip service to that right, she does not actively value it in her analysis. The trial court should have considered the clear and substantial evidence presented by Appellants that the Sequoia Advantage DREs can be easily modified to alter election results, "intruding" on and depriving New Jersey voters of the right to have their votes counted. If she had taken that evidence seriously, the court should have concluded that there is absolutely no public need for the use of the paperless Sequoia Advantage DREs.

The use of DREs without a voter-verified paper ballot violates the right to equal protection guaranteed by the New Jersey Constitution. Proper application of the Greenberg test would have led the court to enter judgment in Appellants' favor. See, Greenberg, 99 N.J. at 567. Therefore, Appellants respectfully request that this Court reverse the trial court's findings and order the State to adopt auditable voting machines that are capable of ensuring that all votes cast by of New Jersey citizens are counted as cast.

E. The Trial Court Erred in Finding That the Internal Memory of the Sequoia Advantage 9.00H Served as an Adequate Audit Trail Under N.J.S.A. 19:48-1(B).

The trial court erroneously found that the internal memory on the Sequoia Advantage 9.00H serves adequately as an audit trail under N.J.S.A. § 19:48-1(b). In 2005, the New Jersey Legislature passed a law that states: "[E]ach voting machine shall produce an individual permanent paper record for each vote cast, which shall be made available for inspection and verification by the voter at the time the vote is cast, and preserved for later use in any manual audit." N.J.S.A. § 19:48 1(b).

The trial court erroneously found that the internal memory on the Sequoia Advantage serves as an audit trail to satisfy this statute. (Gusciora, slip op. at 128 (Law Div. Feb. 1, 2010); Pa269.) No evidence was presented at trial to support that finding. The trial court's legal finding is even more peculiar because the State did not even argue that the voter-verified paper ballot requirement was satisfied by the Sequoia Advantage 9.00H.

The trial court erroneously concluded that the Sequoia Advantage already includes four separate 'audits' on its internal memory. (Gusciora, slip op. at 74 (Law Div. Feb. 1, 2010); Pa215.) The trial court stated that the internal memory

on the Advantage "provides voter verification and the ability to conduct recounts," Id. at 1197; Pa338, even though the plain fact that the memory is "internal" makes it impossible for voters to "verify" it as required by law. The trial court also found "no evidence to support a failure to adhere to the statutory requirements under Title 19." (Gusciora, slip op. at 178 (Law Div. Feb. 1, 2010); Pa319.)

The trial court's decision was based on her determination that the Advantage "keeps vote totals (with ballot images in its internal memory . . . [and that] the machine can be instructed to print the internally stored data onto its printer." Id. at 162; Pa303. While this statement may be accurate, the ballot images do not in any way comply with the requirements of the statute.

It is true that votes are stored in four different redundant ways on the Sequoia Advantage 9.00H. (Appel Test., 2/9 Trial Tr., 111:14–112:21; see also Appel Report, at § IV at 88-105; Ex. P-2; Pa619-36.) But the Court ignored that Prof. Appel demonstrated that all four of these electronic images could be easily hacked! Id. Prof. Appel demonstrated to the trial court that he designed a fraudulent program to change votes, not only in the vote totals, but also in the recorded ballot images in each of those four places where vote totals are stored. Id. Prof. Appel was able to hack the Advantage by installing

fraudulent firmware that not only altered the vote totals, but also altered:

- the vote totals produced on the results report from the file containing the vote totals in the DRE's memory;
- the file containing vote totals but that also altered the vote totals produced on the results cartridge;
- the ballot images in the audit file in the DRE's internal memory;
- the ballot images in the audit file on the results cartridge.

(Appel Test., 1/28 Trial Tr. at 111:17 to 112:13; see also DVD 1; Ex. P-3; Pa728.

Prof. Appel's fraudulent firmware altered the vote totals in all four forms in which data is saved by the Advantage so that all the results appear consistent. (Appel Test., 1/28 Trial Tr. at 111:14-24.) The printout and all four electronic records of the election created by the DRE were completely consistent, even though they were all fraudulent. (Appel Test., 1/28 Trial Tr. at 111:14 to 113:10.)

Furthermore, once installed, the fraudulent firmware is impossible to detect. (Appel Test., 1/28 Trial Tr. at 121:15 to 122:5.) Because these four records are the only record of what actually happened in the election, there is no way to verify

after the fact that the results are real, rather than the product of fraudulent firmware. Id.

Nothing survives the operation of Prof. Appel's fraudulent firmware to contradict (or even expose) the fraudulent results. (Appel Test., 1/28 Trial Tr. at 111:14 to 113:10.) Prof. Appel showed that there was no evidence of tampering, and no independent means by which the totals can be audited. (Appel Test., 1/28 Trial Tr. at 121:15 to 122:5.) Prof. Appel's fraud was not detected. No record of the actual votes cast survived his tampering with the DRE. The poll workers' printout and all four electronic records of the election created by Prof. Appel's fraudulent firmware were completely consistent, even though they were all fraudulent. (Ex. P-21; Pa750). The State does not contest this testimony in any way.

Prof. Appel also demonstrated at trial that the hacked fraudulent election results cartridge would not be detected by vote tabulation software used by the county clerk after the election. Id. The hacked data was also not detected by the results cartridge that transmits election totals from each voting machine to the county clerk's office. Id.

After each election, vote totals are transferred onto a cartridge. That cartridge is read by the WinEDS computer at the County Clerk's office. (Appel Test., 1/28 Trial Tr. at 4:22 to 5:8., see also Gentile Test., 2/23 Trial Tr. at 54:7-15.) Prof.

Appel transferred the fraudulent vote totals from the Sequoia Advantage DRE and transferred them to the WinEDS computer. (Appel Test., 1/28 Trial Tr. at 121:2-6; DVD 1, 18:47; Ex. P-3; Pa728.) The WinEDS computer owned by the county did not detect the fraudulent results; it merely tabulated the fraudulent vote totals just as if they were legitimate. (Id.) Thus, once Prof. Appel's fraudulent program was introduced into the Advantage, it corrupted all of the results of the election.

As such, the true expression of the will of the people is gone forever and cannot ever be determined. Prof. Appel's fraudulent firmware demonstrates a basic tenet of computer science: A computer will do whatever it is programmed to do. The Sequoia AVC Advantage 9.00H DRE is no exception to this rule. (Appel Test., 1/28 Trial Tr. at 22:25 to 23:11.)

In sum, the trial court's finding of the hackable internal memory of the Sequoia Advantage DRE as an audit that satisfies N.J.S.A. § 19:48-1(b) is unsupported by any evidence. The trial court's findings are akin to saying that an image of a fraudulent check is proof that the check was legitimate. Her findings are surprising, particularly because the State never refuted that Prof. Appel hacked the Sequoia Advantage 9.00H in all places where election data was stored. The State also never argued that the internal memory of the Advantage was a VVPAT that satisfies the requirements of N.J.S.A. 19:48-1(b).

This Court should use its broad authority, Manalapan Realty, 140 N.J. at 378, to reverse the trial court's erroneous conclusion and order the immediate implementation of Title 19's independent paper ballot requirement.

F. The Court Below Fundamentally Erred in Holding That Appellants' Claims Give Rise to any Separation of Powers Issue Because the Appellate Division Has Expressly Held Otherwise.

It is undisputed that the Appellees have failed to implement a voter-verified paper ballot that would ensure that every vote in this state is counted as cast, as required by statute. See N.J.S.A. 19:48-1. Although the deadline for the implementation of New Jersey's voter-verified paper ballot law has been pushed back for fiscal reasons, the law remains intact. Tellingly, the New Jersey Legislature had the opportunity to revoke the law several times, but did not do so. Rather, as discussed above, it strengthened it in 2008, by enacting a hand-count audit at every precinct. N.J.S.A. § 19:61-9.

In 2006, while considering Appellants' claims, this Court properly recognized that "the constitutional issue would remain if the [voter-verified paper ballot legislation] is not timely and successfully implemented." Gusciora v. McGreevey, 395 N.J. Super. 422, 426 (App. Div. 2006). That is exactly what happened here. In light of Appellees' continuing failure to implement a voter-verified paper ballot, according to this Court's prior

opinion, Appellants still have constitutional claims that are unaffected by any separation of powers concerns.

In her analysis of Appellants' constitutional claims, the trial court incorrectly held that the Appellees are entitled to a "deferential standard" that is "rooted in separation of powers principles." (Gusciora, slip op. at 167 (Law Div. Feb. 1, 2010); Pa321.) The trial court adopted a recycled version of the Appellees' argument that was expressly rejected by this Court in 2006. The trial court's adoption of this argument constitutes a fundamental error in its analysis. This conclusion is in direct contrast to this Court's 2006 holding that there is "no separation of powers issue" that prevents the Law Division from considering Appellants' claims. Gusciora, 395 N.J. Super. at 427.[27] Specifically, this Court held:

> [I]f there is a constitutional issue presented by the lack of implementation of the new law and an appropriate record can be made to support the constitutional claim of disenfranchisement, there would be no

[27] As stated on page 9 of Plaintiffs' Reply to Defendants' Conclusions of Law: "After five years of litigation, the Defendants still contend that 'Plaintiffs are free to petition the Legislative and Executive Branches for changes to the voting systems, but they can find no such relief before this Court.'" (Defs.' COL at 3.) This argument has no merit. Indeed, in 2006, the Appellate Division rejected the very same Separation of Powers argument. Gusciora v. McGreevey, 395 N.J. Super. 422, 427 (App. Div. 2006). Both the law and procedural history of this case make clear that this matter falls squarely within the Court's ambit.

> separation of power issue preventing the Law Division's consideration of the matter.

Id. Therefore, this Court should use its broad scope of review, Manalapan Realty, 140 N.J. at 378, to reverse the trial court's ruling that Appellees are entitled to a "deferential standard."

1. The Court Below Fundamentally Erred in Holding That Appellants' Claims Give Rise to Any Separation of Powers Issue Because the Separation of Powers Cases Cited by the Court are Inapplicable to Appellants' Claims.

In her analysis of Appellants' constitutional claims, the trial court cited to N.J. Sports & Exposition Auth. v. McCrane, 119 N.J. Super. 457 (Law Div. 1971), modified by, 61 N.J. 1 (1972), app. dismissed by, 409 U.S. 943 (1972), app. after remand at, 62 N.J. 248 (1973), cert. denied, 414 U.S. 989 (1973), to support her finding that, "[o]ut of respect for the democratic process, and in recognition of the legislature's status as a co-equal branch of government, statutes under attack are entitled to great weight by the courts." (Gusciora, slip op. at 180 (Law Div. Feb. 1, 2010); Pa321). As an initial matter, and as discussed in Section IB and IC of the "Legal Argument" Section of this Brief, this proposition is irrelevant to Appellants' claims because Appellants are not challenging the validity of Title 19 or any other statute. Moreover, the Law Division's holding in N.J. Sports & Exposition Auth. is wholly inapplicable to Appellants' claims.

In actuality, proper consideration of the separation of powers would have compelled the trial court to find in favor of Appellants. Appellants seek an order requiring Appellees to comply with the clearly expressed intentions of the Legislature. In 2005, the Legislature enacted, and the Governor signed, a law requiring the State to equip New Jersey's voting machines with voter-verified paper ballots to by January 1, 2008. P.L. 2005, c. 137 (codified both in N.J.S.A. 19:48-1 and N.J.S.A. 19:53A-3). Further, the 2005 law mandated that the permanent paper record be preserved for later use in any manual audit. Id. In 2008, the Legislature enacted a law requiring the Attorney General to appoint an independent, professional audit team each year for the purpose of overseeing random hand-to-eye counts of the voter-verified paper ballots. P.L. 2005, c. 349 (codified in N.J.S.A. 19:61-9). Appellants are seeking to enforce these statutes while it is the Appellees who have failed to comply.

The trial court inappropriately considered N.J. Sports & Exposition Auth., in its analysis of Appellants' claims. In N.J. Sports & Exposition Auth., the newly created New Jersey Sports and Exposition Authority instituted suit for declaratory judgment challenging the validity of the New Jersey Sports and Exposition Authority Law. N.J. Sports & Exposition Auth., 119 N.J. Super. at 465. A central issue in dispute was "whether the provisions of the act under consideration satisfy the

constitutional requirement of fostering a valid public purpose." Id. at 472. Concluding that the determination of what constitutes a "public purpose" was "primarily a function of the Legislature," the Law Division affirmed the constitutionality of the statute and granted summary judgment in favor of the Authority. Id. at 473, 566.

In clear contrast to N.J. Sports & Exposition Auth., the determination of whether the Sequoia Advantage DREs comply with the New Jersey Constitution and Title 19 is clearly a task for the judiciary. As such, and also in light of the fact that Appellants are not challenging the validity of any statute, judicial resolution of this matter poses no threat to the separation of powers.

The trial court continued in her erroneous application of separation of powers principles to Appellants' constitutional claims, citing Roe v. Kervick, 42 N.J. 191 (1964), and State Farm Mutual Automobile Ins. Co. v. State, 124 N.J. 32 (1991). The trial court used these cases to support the proposition that legislative acts are presumed valid and legislative judgments deserve deference from the judiciary (Part IV, Section F, p. 175 of the Court's Opinion). That principle may be correct, but Roe and State Farm, like N.J. Sports & Exposition Auth., are wholly inapplicable to the issues before the Court.

In Roe, the New Jersey Area Redevelopment Authority sought a declaratory judgment as to the constitutionality of legislation authorizing the transfer of funds to the Authority. Roe, 42 N.J. at 197. As in N.J. Sports & Exposition Auth., a central issue in dispute was whether the funds in question were to be expended in furtherance of a "public purpose." Id. at 207. In Roe, the Court reasoned that the Legislature's determination that the challenged statutory scheme constituted a valid public purpose was "entitled to great weight in the courts." Id. at 230. As such, in Roe, the Court affirmed the constitutionality of the challenged legislation. Id. at 233.

Similarly, in State Farm, automobile insurance companies challenged the constitutionality of the Fair Automobile Insurance Reform Act on the basis that certain of its surtaxes and assessments constituted takings without just compensation. State Farm, 124 N.J. at 38. Finding that the determination of the constitutionally-required rate of return to insurance companies had properly been placed in the ambit of the Department of Insurance, the State Farm Court upheld the facial constitutionality of the challenged Act. Id. at 62, 66.

Roe and State Farm are plainly distinguishable from the present matter. Here, Appellants are not challenging the constitutional validity of Title 19 or any other statute. Rather, Appellants are asking the Court to find that the Sequoia

Advantage DREs fail to satisfy the requirements of the New Jersey Constitution and Title 19. The resolution of Appellants' claims is therefore a task squarely within the province of the Judiciary.

The trial court then cited to four cases in support of the proposition that a significant burden must be overcome in order for a court to strike down a State statute or regulation. Gangemi v. Berry, 25 N.J. 1 (1957) (in which plaintiffs challenged the constitutionality of New Jersey's Absentee Voting Law); Bell v. Twp. of Stafford, 110 N.J. 384 (1988) (in which plaintiffs challenged a municipal ordinance prohibiting billboards within any zoning district of the township); David v. Vesta, 45 N.J. 301 (1965) (in which plaintiffs challenged the constitutionality of the housing accommodation sections of the New Jersey Law Against Discrimination); Knight v. Margate, 86 N.J. 374 (1981) (in which plaintiffs challenged the constitutionality of amendments to the New Jersey Conflicts of Interest Law prohibiting certain public employees from dealing with casinos). However, as with each of the other separation of powers cases cited by the trial court, these cases are inapplicable to this matter because Appellants are not challenging any statute or legislative act. As such, Appellants' claims need not overcome the significant burden applicable in challenges to legislative acts.

Finally, the trial court erred in concluding that Sharrock v. Keansburg, 15 N.J. Super. 11 (App. Div. 1951), or Gormley v. Lan, 88 N.J. 26 (1981) (Handler, J., concurring and dissenting) have any bearing upon this case in which Appellants are seeking to have Appellees comply with Title 19 and the New Jersey Constitution. In dicta, the Sharrock Court observed that "courts refrain from an indulgence in any judicial action that refashions legislation regulating and facilitating the conduct of elections and which is calculated to secure the right of suffrage and the free expression of choice of the voter." Sharrock, 15 N.J. Super. at 16. Echoing this sentiment, Justice Handler's concurring and dissenting opinion in Gormley emphasized that the Attorney General's formulation of an interpretative statement on a ballot is entitled to "considerable deference" by the judiciary. Gormley, 88 N.J. at 46 (Handler, J., concurring and dissenting). As demonstrated above, Appellants in this matter are seeking an order requiring Appellees to comply with the legislative intent clearly expressed by the voter verified paper ballot legislation codified in N.J.S.A. 19:48-1 and N.J.S.A. 19:61-9. The trial court's citation to general separation of powers language from Sharrock and Gormley was therefore wholly inappropriate.

The trial court's improper consideration of separation of powers cases, and the inappropriate deference afforded to

Appellees, constitutes a fundamental error in the trial court's analysis. As such, Appellants respectfully request this Court reverse the trial court's judgment and grant Appellants' requested relief.

G. The Trial Court Severely Prejudiced the Appellants When It Allowed the Appellees to Convert Two Clearly Biased Sequoia Employees from Fact Witnesses to Expert Witnesses After the Trial Had Started.

The trial court improperly allowed two unqualified Sequoia Employees, Paul Terwilliger and Edwin Smith ("Sequoia Employees"), to testify as expert witnesses even though they did not file expert reports in accordance with R. 4:17-4, and even though they were never listed as expert witnesses in any pre-trial materials, in violation of R. 4:17-7. The trial court also erred in letting the Sequoia Employees testify as experts despite their clear conflicts of interest. Because these critical legal errors severely prejudiced Appellants, this Court, owing no deference to the trial court, should use its broad authority, Manalapan Realty, 140 N.J. at 378, to reverse the trial court's legal conclusions.

A trial court's decision to permit expert testimony is reviewable by this Court. Carbone v. Warburton, 11 N.J. 418, 424 (1953); see also, Carey v. Lovett, 132 N.J. 44, 64 (1993). "In reviewing [the trial court's] decision to admit expert testimony . . . [this Court is] required to reverse when there has been a

clear 'abuse of discretion.'" State v. Free, 351 N.J. Super. 203, 221 (App. Div. 2002) (citing Little Egg Harbor v. Bonsangue, 316 N.J. Super. 271, 278 (App. Div. 1998)). "An abuse of discretion occurs when the trial judge's 'decision [was] made without a rational explanation, inexplicably departed from established policies, or rested on an impermissible basis.'" State v. Belliard, 415 N.J. Super. 51, 87 (App. Div. 2010) (quoting United States v. Scurry, 193 N.J. 492, 504 (2008)), certif. denied, 205 N.J. 81 (2011). Here the trial court abused its discretion by permitting the Sequoia Employees to be converted to expert witnesses after the trial had started, despite their failure to meet the requirements of established rules, R. 4:17-7, and despite their clear financial interest in the outcome of this case. Her reliance on their testimony is irrational and impermissible

In over four years of litigation that preceded the second trial in this case, the Appellees never articulated any intent to call Edwin Smith and Paul Terwilliger as expert witnesses. In all pre-trial materials, the State listed only one expert witness, Dr. Michael Shamos.

On January 27, 2009, just before the start of trial, the Court ruled that Dr. Shamos would not be allowed "to testify as to whether in his opinion the voting machines are scientifically accurate and reliable," the core legal issues in this case.

(Colloquy, 1/27 Trial Tr. at 38:4-6.) This is because Dr. Shamos never examined the Sequoia 9.00H voting machine that was the subject of the trial. (Shamos Test., 3/23 Trial Tr. at 73:4-7.)

A week later, on February 4, 2009, four days after the trial started, Appellees' attorneys notified Appellants by letter that the "State Defendants intend to call Sequoia representatives Ed Smith and Paul Terwilliger as experts in our case in-chief." (Colloquy, 2/5 Trial Tr. at 4:13-6:3.) This was the very first time that Appellants were notified of the State's intention to convert Mr. Smith and Mr. Terwilliger from fact witnesses into expert witnesses. (Id.) Appellants raised objections to the elevation of the Sequoia Employees from fact witnesses to expert witnesses with the trial court the next morning. (Id.)

1. The Court Acknowledged That the Sequoia Employees Did Not Meet the Requirements of R. 4:17-4(e).

The trial court admitted that changing the Sequoia Employees from fact witnesses to expert witnesses was problematic. She admitted that a statement written by anonymous sources at Sequoia on October 2, 2008 violated R. 4:17-4(e). That rule outlines the requirements of expert reports and requires that expert reports be "rendered by the expert." R. 4:17-4(e). It also requires that expert reports contain "a

complete statement of that person's opinions and the basis therefore; the facts and data considered in forming the opinions; the qualifications of the witness, including a list of all publications authored by the witness within the last ten years." Id.

According to the text itself, the October 2, 2008 Sequoia Response was not an expert report. It was posted on the Internet with the "purpose" of "provid[ing] a response to the Plaintiff's [sic] report in a lawsuit against the State of New Jersey regarding voting equipment." (Ex. D-17, at 1; Pa1745.) Indeed, Sequoia was not permitted by the trial court to submit any kind of expert report, nor did Sequoia ever seek permission to do so. The State also never requested that Sequoia be permitted to file an expert report and the State did not submit the Sequoia Response as its own expert report.

The Sequoia Response did not identify itself as an expert report, nor was Sequoia told by the State of New Jersey that it was drafting an expert report. (Smith Test., 3/19 Trial Tr. at 34:21 to 35:10.) The October 2 Sequoia Response did not contain any background or qualifications of the authors or any information about the compensation received for services in generating the report. Indeed, the Sequoia Response was unsigned and had no author. (Ex. D-17, at 1; Pa1745.) The trial court

itself recognized that the document did not have the "indicia of an expert report." (Colloquy, 2/23 Trial Tr. at 10:14-21.)

Compared to Prof. Appel's meticulous and detailed expert report, that of the Sequoia Employees was nothing more than promotional material for Sequoia's products, combined with disparaging ad hominem attacks on Appellants' experts. The report appears to have been drafted by an unknown third party. (Terwilliger Test., 3/30 Trial Tr. at 78:13-14; Smith Test., 3/18 Trial Tr. at 83:13-15). Far from giving a notification of the "experts" proposed testimony, it was authored by neither of them. In fact, at trial, neither witness could explain the origin of the expert report or support its contents with testimony.

The trial court acknowledged that the October 2, 2008 Sequoia Response did not provide "CVs . . . [or] documents that would indicate the background" of the Sequoia witnesses and did "not have all the indicia of an expert report." (Colloquy, 2/23 Trial Tr. at 6:5-7, 10:14-16.) Yet, the trial court erroneously allowed the Sequoia Employees to testify as experts:

> I'm inclined to permit that, because this is a public interest case -- I can think of no other case that is as important from a public interest perspective -- for the Court not to have the opportunity to hear from two individuals who have been intimately involved in this machine.

(Colloquy, 2/23 Trial Tr. at 11:7-12.) The trial court, by her own admission, bent the rules for the Sequoia Employees allegedly for the public interest, ignoring the New Jersey Court Rules and the great prejudice her decision caused Appellants.[28]

2. The Trial Court Acknowledged That The Sequoia Employees Did Not Satisfy R. 4:17-7.

The trial court also admitted that permitting the Sequoia Employees to testify as expert witnesses ran afoul of R. 4:17-7. R. 4:17-7 requires that "amended answers [to interrogatories] be served not later than 20 days prior to the end of the discovery period." In the State's answers to the Appellants interrogatories, the State identified Dr. Shamos as the only expert witness. In the same interrogatory answers, the State identified Mr. Smith and Mr. Terwiliger as fact witnesses.

The discovery period ended on December 22, 2008. Because the trial commenced on January 28, 2009, after the 20-day deadline to file amended answers to interrogatories had passed, the Appellees could not change the status of its fact witnesses to expert witnesses. The trial court even admitted that the

[28] Despite her stated concern for the public interest, the trial court refused to permit Appellants' expert witness, Dr. Johnston, to testify about a hack of the voting machine that he devised and discussed in full in his original report, which met all of Rule 17's requirements. That exclusion prejudiced the Appellants because Dr. Johnston's hack was central to the issues in this litigation: the insecurity and vulnerability of the State's voting machines. This issue will be discussed in greater detail infra.

Appellees did not meet R. 4:17-7's deadline. (Colloquy, 2/23 Trial Tr. at 27:8-19.)

Yet, the trial court again ignored that the Sequoia Employees did not satisfy New Jersey Court Rules and allowed both Sequoia Employees to testify as experts. In doing so, she again cited to the public interest:

> And the only reason I'm going to allow Smith and or Terwilliger to testify as to what's in that report is because that report was provided October 2nd. If that report was not provided, the result would be different, because part of weighing this public interest is also weighing this fairness issue. So I'm going to allow them to testify.

(Colloquy, 2/23 Trial Tr. at 27:12-20.)

By allowing the Sequoia Employees to testify, the trial court allowed precisely the sort of situation that R. 4:17-4 and R. 4:17-7 were intended to prevent-surprise and prejudice after the close of discovery or at trial. As such, in order to correct the severe prejudice inflicted upon Appellants by the trial court's failure to deny the testimony of the two Sequoia Employees, Appellants respectfully request this Court reverse the trial court's findings and grant Appellants' requested relief.

H. The Trial Court Improperly Permitted Biased Witnesses with Financial Interests in This Case To Testify.

1. Both Sequoia Witnesses Have a Financial Interest in the Outcome of this Case.

Mr. Terwilliger and Mr. Smith were both employed by Sequoia voting systems. (Smith Test., 3/18 Trial Tr. at 16:11-17, 54:17-19; Terwilliger Test., 3/30 Trial Tr. at 67:24 to 68:14.) They both admitted that the outcome of this case could impact them financially. (Smith Test., 3/18 Trial Tr. at 54:22 to 55:6; Terwilliger Test., 3/30 Trial Tr. at 69:19 to 70:5.) As will be discussed in greater detail below, the trial court improperly permitted the testimony of Appellees' biased witnesses with conflicts of interest. Therefore, this Court should exercise its broad scope of review, Manalapan Realty, 140 N.J. at 378, to reverse the trial court's judgment. See Carbone, 11 N.J. at 424; Carey, 132 N.J. at 64; Free, 351 N.J. Super. at 221 ("[This Court is] required to reverse when there has been a clear 'abuse of discretion.'").

Courts routinely and properly afford diminished or no weight to the testimony of an expert who has an economic interest related to the parties or subject matter of the litigation. See, e.g., Thermographic Diagnostics, Inc. v. Allstate Ins. Co., 125 N.J. 491, 497 (1991) (concluding that experts' financial interest in company that owned medical

equipment at issue impaired objectivity of their testimony); Interfaith Cmty Org. v. Honeywell Int'l, Inc., 263 F. Supp. 2d 796, 812 (D.N.J. 2003). In Interfaith Community, 263 F. Supp. 2d at 812, the District Court of New Jersey rejected the testimony of the defendant's expert witness because "it [was] evident that [the witness] owed his livelihood to his ongoing relationship with [the defendant]." The District Court ruled that this unfairly biased the expert witness in favor of the defendant. Id. As in Interfaith Community, here it was an abuse of the trial court's discretion to admit testimony of three experts who have a financial stake in the outcome of this case, and who also failed to satisfy the requirements of R. 4:17-7.

a. Appellees' Witness, Mr. Smith, Has a Financial Interest in the Outcome of This Case and Was Permitted to Testify About Matters About Which He Admitted He Had No Expertise.

Mr. Smith testified that he maintains an ownership interest in Sequoia and admits that his annual bonus is dependent on the outcome of this case because it is possible that 20% of Sequoia's business derives from New Jersey. (Smith Test., 3/18 Trial Tr. at 54:14-55:6, 56:24-59:20.)

In addition to this clear conflict of interest, Mr. Smith does not possess a degree in computer science, has no knowledge of security measures in New Jersey, and was not involved in any of the certification or compliance efforts for the Advantage in

New Jersey because he came on board with Sequoia in 2006; well after this case commenced. (Smith Test., 3/18 Trial Tr. at 17:6-18:1-7, 77:6-15.)

During Mr. Smith's testimony, he blatantly and repeatedly contradicted his deposition testimony in self-serving manners and made statements at sharp variance with the statements of every other witness in the case, including the State's expert, Dr. Shamos, and even fellow Sequoia employee Mr. Terwilliger.

Some of Mr. Smith's testimony was so jaw-droppingly bizarre that even Appellees' other witnesses disagreed with him. For example, Mr. Smith did not even believe that negative vote totals would be a problem or could alter the outcome of an election. (Smith Test., 3/19 Trial Tr. at 138:23-25 to 139:4.) By comparison, even Mr. Terwilliger, another of Appellees' "experts" and a Sequoia employee, agreed with Prof. Appel's assessment that negative vote totals can manipulate elections. (Terwilliger Test., 3/30 Trial Tr. at 166:16-19.)

Indeed, Mr. Smith testified on matters about which he admitted he had no expertise, attempting to contradict the Chair of the Princeton Computer Science Department, Prof. Appel. Specifically, Mr. Smith disagreed with Prof. Appel on whether flash memory on the daughterboard was vulnerable. (Smith Test., 3/19 Trial Tr. at 140:2-11.) Despite the fact that Mr. Smith admitted that he was not even sure there was flash memory on the

daughterboard, he disagreed with Prof. Appel's professional computer science findings on the subject, stating that there was no security issue. (Smith Test., 3/19 Trial Tr. at 138:15-17.) This is despite the fact that not a single other witness, not even fellow Sequoia employee Mr. Terwilliger, agreed with Mr. Smith's contention that having program memory in easily replaced memory cards is not a dangerous practice. (Terwilliger Test., 3/30 Trial Tr., at 109:17-18; Appel Test., 1/28 Trial Tr. at 61:10-17; Appel Report, § 19.10, 56-57; Pa588-89.)

Even Dr. Shamos, another of Appellees' expert witnesses, fully agreed with Prof. Appel that flash memory on the daughterboard places the disabled, the most vulnerable voters, at risk of having their votes stolen. (Shamos Report, ¶ 102, 24; Ex. D-21.) Indeed, Dr. Shamos's rebuttal report considers the severity of the flash memory vulnerability to be one of the most severe DRE flaws to date. (Id.)

Mr. Smith has not performed any experimentation in connection with any of his proffered areas of expertise nor has he offered any peer-reviewed articles with respect to those. (Smith Trial Test., 3/18 Trial Tr., 77:6-15.) Also, his expertise on quality control and assurance had nothing to do with what was done in the manufacturing of the AVC Advantage. (Id.) Despite all of this, Mr. Smith was allowed to testify in

the areas of certification and compliance, physical security, quality assurance, and methods.

Mr. Smith's bias was also obvious by the ease with which he changed his testimony. At his deposition, he testified that fraudulent firmware can be designed so as to avoid detection. (Smith Test., 3/18 Trial Tr. at 193:10-14.) At trial, he changed his mind, stating that designing such fraudulent firmware would be "extremely, extremely difficult." (Smith Test., 3/18 Trial Tr. at 193:6-7.)

As these examples show, Mr. Smith is clearly willing to testify, without any knowledge or reasonable factual foundation, in any way that best serves his interests and that of Sequoia. He is apparently completely unembarrassed to testify about matters he knows nothing about and to disagree with every other witness in the case, and his own prior testimony. This shows a bias so pervasive and overwhelming that his testimony should be disregarded in its entirety.

The trial court noted Mr. Smith's interest in the outcome of the litigation, and stated that the credibility of Mr. Smith's testimony must be weighed accordingly. (Smith Test., 3/18 Trial Tr. at 82:11-15.) However, the trial court's opinion is entirely devoid of any indication that she did, in fact, consider the matter at all. The trial court's opinion does not

mention Smith's financial interest at all, and cites extensively to his testimony.

The trial court thus erred in permitting Smith to testify as an expert and to accord any weight to the testimony of Mr. Smith, who clearly demonstrated bias and glaring conflicts of interest.

b. Appellees' Witness, Mr. Terwilliger, Has a Financial Interest in the Outcome of This Case and Conducted Illegal Activities on Behalf of Sequoia.

Similarly, dating from the time that Mr. Terwilliger worked at Sunrise Laboratories approximately two decades ago all or substantially all of Mr. Terwilliger's income has derived from work he performs for Sequoia. (Terwilliger Test., 3/30 Trial Tr. at 67:24 to 68:14.) From 1997 to 2007, when Mr. Terwilliger was an employee of Sequoia, his bonuses were at least in part a function of the company's sales performance. (Terwilliger Test., 3/30 Trial Tr. at 68:20-22.) Mr. Terwilliger served as a consultant for Sequoia, and was working on a firmware modification for the Sequoia Advantage D-10 at the time of trial. (Terwilliger Test., 3/30 Trial Tr. at 69:17-18.)

Mr. Terwilliger had no source of income other than the compensation that he received from Beattie Padovano (Sequoia's counsel in this lawsuit) for his services as an advisor/expert witness in this litigation, and the pay that he received from

Sequoia for his consulting services. (Terwilliger Test., 3/30 Trial Tr. at 69:19 to 70:5.) Mr. Terwilliger admitted that although he purportedly testified on behalf of the State, he took his direction from Arthur Chagaris (Sequoia's counsel), as well as Ed Smith, and Michelle Shaffer (Sequoia's Director of Communications). (Terwilliger Test., 3/30 Trial Tr. at 72:20 to 73:3.)

Mr. Terwilliger's bias in favor of Sequoia was apparent by his illegal activities on behalf of Sequoia. In 2003, during the course of his employment with Sequoia, Mr. Terwilliger personally registered to himself several Internet domain names that he admitted were variations on "Diebold," a competitor of Sequoia. (Terwilliger Test., 3/30 Trial Tr. at 74:19-24.) Mr. Terwilliger admitted that his actions constituted "cyber-squatting." (Terwilliger Test., 3/30 Trial Tr. at 73:8-22.) Cyber-squatting is illegal pursuant to the Anti-Cyber-Squatting Consumer Protection Act of 1999, codified at 15 U.S.C.A. § 1125(d). Diebold filed a legal proceeding against Terwilliger before the World Intellectual Property Organization ("WIPO"). (Terwilliger Test., 3/30 Trial Tr. at 75:5-8; Pa913.) The WIPO panel ruled that the domain names must be turned over to Diebold, finding that Mr. Terwilliger had registered the names in bad faith. (Terwilliger Test., 3/30 Trial Tr. at 75:9-77:9; Pa915.) Although Mr. Terwilliger registered these domain names

personally, he testified that he registered them at the direction of Sequoia officials. (Terwilliger Test., 3/30 Trial Tr. at 74:4-12.)

Even after the trial court erroneously allowed the Sequoia Employees to testify as experts, she erred yet again in allowing them to testify beyond what they were initially limited to discussing. The trial court initially limited Mr. Terrwilliger to testifying about an expert report that he claimed to have authored, along with Mr. Smith and another unidentified party. (Coloquy, 2/23 Trial Tr., 10:24, 11:1-4.) Mr. Terwilliger testified about the voting machine certification process which was not thoroughly discussed in his report. (Terwilliger Test., 3/30 Trial Tr., 37:5-25.) The trial court reasoned that Mr. Terwilliger "has been intimately involved with the certification process." (Terwilliger Test., 3/30 Trial Tr., 38:4-9.)

The trial court allowed Mr. Terwilliger to testify about something that was not in the October 2 Sequoia letter on the grounds that she "[could] think of no other case that is as important from a public interest perspective." (Colloquy, 2/23 Trial Tr., 11:6-12.)

2. Dr. Shamos Has a Substantial Financial Stake in the Outcome of This Litigation.

During the course of his cross examination, Dr. Shamos testified extensively about his own conflicts of interest.

Appellants extensively briefed the trial court on this issue. Despite this, the trial court entirely disregards Dr. Shamos's multiple glaring conflicts of evidence, as well as his demonstrated bias.

The unrebutted evidence showed that Dr. Shamos has performed, and continues to perform, extensive expert witness work for Sequoia Voting System. Dr. Shamos was paid between $209,000 and $236,500 for between 300 and 350 hours of work, at $525 an hour, as an expert for Sequoia in a single patent suit, which was resolved in 2008. (Shamos Test., 3/24 Trial Tr. at 90:1-3; 92:13-14; 94:18-22; 95:2-11.) Further, Dr. Shamos expected to be retained as an expert in at least two other ongoing patent lawsuits, in which he expected to be paid approximately the same amount, that is, in excess of $450,000 more. Id.

If the Sequoia AVC Advantage 9.00H DRE were found to be defective, the value of its patents would be worth far less. Similarly, Dr. Shamos stands to lose future income if he testifies in any way to the detriment of Sequoia, which is unlikely to want to hire an expert who disparages its products. Therefore, Dr. Shamos is not at liberty to testify negatively about Sequoia's products without risking a substantial loss of future income. This substantial stake in the outcome of the current litigation would raise the suspicions of even a trusting

person that Dr. Shamos's opinions are not objective when they concern the products of a corporation which provides him with a substantial part of his income.

Indeed, Dr. Shamos is, by his own admission, virtually alone in the computer science field in his endorsement of paperless DREs. When asked at trial to name any qualified experts who agreed with his views on paperless DREs, Dr. Shamos named Profs. Ted Selker and Juan Gilbert. (Shamos Test., 3/24 Trial Tr. at 83:8-84:17.) When confronted on cross-examination with an article written by Prof. Selker lauding optical-scan voting systems, Dr. Shamos admitted that Prof. Selker supports software independence and precinct based optical scanners, and does not support paperless DREs. (Shamos Test., 3/24 Trial Tr. at 109:20 to 110:3.) Further, Dr. Shamos admitted that Prof. Gilbert's own invention, the Prime III voting machine, uses a software independent voter verified paper audit trail, and is not a paperless DRE. (Shamos Test., 3/24 Trial Tr. at 113:4-7.)

Further, the trial court erroneously found that Dr. Shamos spent a "few hours with the voting machines in Trenton." (Gusciora, slip op. at 100 (Law Div. Feb. 1, 2010); Pa241.) Dr. Shamos's own testimony is that of the 140 hours Dr. Shamos spent working on this lawsuit, he spent only one hour with the AVC Advantage 9.00H DRE. (Shamos Test., 3/24 Trial Tr. at 103:10-12.) He could not recall the details of what he did, other than

to verify that the "option switch bug" actually functioned as described in Prof. Appel's expert report. (Shamos Test., 3/24 Trial Tr. at 130:10-12.)

The trial court's legal error in permitting biased witnesses with a financial stake in the outcome of this litigation is irrational and without basis. Thus, it is cause for reversal. See Free, 351 N.J. Super. at 221; Belliard, 415 N.J. Super. at 87. This is particularly true in light of the fact that none of Appellees' expert witnesses conducted scientific experiments on the Sequoia Advantage 9.00H DREs, as did Appellants' witnesses. Cause for reversal is also strong because the trial court did not permit Appellants' expert to testify about a frontal attack on the DRE that was actually in his expert report, and is part of the evidentiary record. Therefore, Appellants respectfully request this Court reverse the trial court's judgment and grant Appellants' requested relief.

I. The Trial Court Erred in Prohibiting Dr. Johnston from Testifying About a Successful Frontal Hack of the AVC Advantage 9.00H, Even Though He Discussed That Hack in His Expert Report, and Even Though the Hack Went to the Heart of the Legal Issues in This Case.

The trial court permitted both Sequoia Employees to testify as expert witnesses in violation of R. 4:17-4(e) and R. 4:17-7, allegedly to serve the public interest. This was the case even

though they had a strong financial interest in the outcome of this case. However, the trial court was not concerned about the public interest when it came to Appellants' expert witnesses. As a result of this glaring inconsistency, the trial court severely prejudiced Appellants. Therefore, this Court should exercise its broad authority, Manalapan Realty, 140 N.J. at 378, to reverse the trial court's judgment.

The trial court severely limited the testimony of Appellants' expert witness, Dr. Robert Johnston, one of the world's foremost experts in physical security. Dr. Johnston was permitted to testify on just two areas of his expertise, (Colloquy, 2/23 Trial Tr., 14:9-12), even though Dr. Johnston's expert report contained thorough analysis of many areas critical to this trial (including physical security, security systems, seals, security culture, cyber security, and the interplay between physical security and cyber security). (Ex. P-81; Pa1068.) Yet, the trial court limited Dr. Johnston's testimony to the lack of security culture in New Jersey and the vulnerability of seals – a small portion of his report. (Johnston Test., 4/21 Trial Tr. 50:10-14:6; Ex. P-81; Pa1068.)

Dr. Johnston performed a successful frontal hack of the voting machine which was discussed thoroughly in his expert report, and which met all the requirements of Rule 17, and

discussed matters of critical public importance. (Johnston Sealed Report, § 138-153 at 31-34; Pa1098-1101.)

The trial court improperly excluded Dr. Johnston's testimony about his ability to make the voting machine cheat by hacking the front of the voting machine. This hack bypassed all of the voting machine seals proposed by the Appellees, and does not require gaining access to the microprocessor (as does Prof. Appel's hack). (Johnston Test., 4/22 Trial Tr. at 149:11-25.)

If the trial court was so intent on serving the public interest, then surely she should have allowed Dr. Johnston to testify about the ease with which an attacker could access the voting machine to steal votes. This Court need only look to the trial court's opinion in order to consider and appreciate the prejudicial effect of the trial court's improper exclusion of Dr. Johnston's testimony with regard to his ability to hack the front of voting machines. The trial court held the following in her written opinion:

> Despite an extended period of time, from the inception of the litigation in October 2004 to the last day of trial on May 11, 2009, plaintiffs have not established any evidence of tampering of an AVC used in an actual election in this State. Instead, plaintiffs were only able to demonstrate a single manipulation in a laboratory setting. Clearly, the court cannot conclude that a voting system that can be manipulated under artificial laboratory conditions should be decommissioned.

(Gusciora, slip op. at 178 (Law Div. Feb. 1, 2010); Pa319.) Dr. Johnston's excluded testimony, of course, constitutes the very evidence that the trial court now faults the Appellants for failing to produce.

Dr. Johnston's testimony on this topic was barred despite the fact that Dr. Johnston's expert report in which he addressed this topic was timely served upon the Appellees, fully explored by the Appellees during his deposition, and actually admitted into evidence. (Johnston Test., 4/22 Trial Tr. at 147:12-15; Johnston Report § 9, at 32-33; Pa1099-1100.)

The New Jersey Court Rules governing expert reports are expressly designed to afford all parties the opportunity to review an expert's "opinions and the basis therefor" in addition to other relevant information about an expert. R. 4:17-4(e). Moreover, while it is well settled that a trial court "may exclude expert testimony which does not fall within the scope" of an expert's report, Gaido v. Weiser, 227 N.J. Super. 175, 192 (App. Div. 1988), aff. by, 115 N.J. 310 (1989), there is simply no such authority for the exclusion of expert testimony that is entirely within the scope of an expert report served upon all parties, explored at deposition, and admitted into evidence at trial. Even in instances in which parties have failed to comply with the rules of discovery relating to expert reports, "courts

have been reluctant to impose the sanction of testimonial exclusion." Id.

In addition to being improper, the trial court's exclusion of Dr. Johnston's testimony was in direct conflict with her earlier ruling in regard to the scope of Dr. Johnston's testimony. During the course of Dr. Johnston's Rule 401 Hearing, the trial court could not have been clearer that Dr. Johnston would be permitted to testify as to the entirety of his expert reports. (4/21 Trial Tr. at 38:23-25 ["I think that what Dr. Johnston should be permitted to testify to is what's in his report"]; Id. at 46:9-13 ["Now, there's a difference between what he may be qualified to testify to and what I'm going to allow him to testify to because Dr. Johnston was, and I believe I indicated, and I let him testify to what was in his report"]; Id. at 49:14-17 ["So from my perspective, he should be allowed to testify as to security culture and as to seals, whatever is in his report, I don't have a problem with it"]).

In justifying the exclusion of Dr. Johnston's testimony, the trial court gave little attention to the matter, and merely expressed concern that the trial would proceed "forever." (Johnston Test., 4/22 Trial Tr. at 149:11-13.) In the trial court's apparent desire to unnecessarily expedite Dr. Johnston's testimony, she also denied Appellants' counsel the opportunity to question Dr. Johnston for purposes of a proffer. (Johnston

Test., 4/22 Trial Tr. at 150:1-5.) The trial court's denial of this request directly conflicts with New Jersey Court Rules, which provide that courts in non-jury trials:

> [S]hall upon request permit the evidence and any cross-examination relating thereto or evidence in rebuttal thereof to be taken down by the court reporter in full, or otherwise preserved, unless it clearly appears to the court that the evidence is not admissible on any ground or that the witness is privileged or unless the interest of justice otherwise requires.

R. 1:7-3 (emphasis added).

In accordance with R. 1:7-3, Appellants preserved Dr. Johnston's anticipated testimony as a record of excluded evidence, now available to this Court for purposes of appellate review. In so doing, Appellants, as a proffer, have prepared "a specific offer of what is expected to be proved by the answer" of Dr. Johnston had he been permitted to testify with regard to his ability to access the interior of Sequoia voting machines, pursuant to R. 1:7-3. State v. Garcia, 185 N.J. 192, 206 (2008). In addition to offering a proffer of evidence, Appellants offer this Court a DVD, prepared after the trial, that visually demonstrates Dr. Johnston's frontal hack. (See Pa1775).[29]

[29] That DVD was prepared by Argonne National Laboratories. A similar hack by Argonne National Laboratories of a different DRE is publicly available. Chris Monty, Diebold Electronic Voting Machine Hacked by Researchers, BLIPPITT (Sept. 30, 2011),

Dr. Johnston's proposed evidence, as discussed in full in his expert report of February 2009 and his proffer, makes clear that the AVC Advantage voting machines can be easily hacked by modifying the front subpanels of the DREs, on site in polling locations, in as little as 20 seconds. (Johnston Report § 9, at 32-33; Ex. P-81; Pa1099-1100.) This means that an attacker can bypass any and all seals and locks placed on the exterior of the DRE by the Appellees and change votes. This also means that the DRE machines can be hacked without ever touching or altering the Advantage's software.

As discussed in Dr. Johnston's report, Dr. Johnston's front panel attack can be performed remotely in "a number of different ways, including with an inexpensive microchip radio frequency receiver such as used by electronics hobbyists." (Johnston Report § 9, at 33; Ex. P-81; Pa1100.) Dr. Johnston explains that a hacker can hijack a complete election on a voting machine by purchasing a $1 microprocessor with a battery. (Id.) When activated remotely, this microprocessor has the ability to feed false settings into the voting machine and thereby completely alter election results. (Id.) In this way, a potential hacker can actually turn his vote tampering software on and off, thereby altering election results with no possibility of

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http://www.blippitt.com/voting-machine-hacked-video/ (last visited Oct. 11, 2011).

detection. (Id.) Dr. Johnston's proposed evidence demonstrates that, since the actual electronic panels of the voting machines are essentially never inspected, the vote tampering software can lay in wait indefinitely. (Id.) Through the use of radio frequency communication, a hacker would then be able to remotely reprogram the fraudulent software to hijack subsequent elections. (Id.)

Appellants were clearly prejudiced by the exclusion of Dr. Johnston's testimony concerning the frontal attack on the Sequoia Advantage 9.00H DRE. In justifying her refusal to decommission the AVC Advantage voting machines, the trial court asserted that Appellants had only demonstrated that the voting machines could be manipulated "under artificial laboratory conditions." (Gusciora, slip op. at 193 (Law Div. Feb. 1, 2010); Pa334.) This finding ignores the frontal attack discussed by Dr. Johnston in his expert report. Dr. Johnston's frontal hack had nothing to do with any laboratory. Had he been permitted to testify to the full scope of his expert report, as the trial court initially ruled that he would, Dr. Johnston would have demonstrated that the AVC Advantage voting machines can be remotely hacked, cheaply and easily, in actual polling locations by amateurs who do not possess any advanced degrees.

The trial court's improper exclusion of this crucial testimony detrimentally affected her analysis of Appellants'

claims. Appellants therefore respectfully request this Court reverse the trial court's judgment and grant Appellants' requested relief.

J. The Trial Court Fundamentally Erred in Its Characterization of the Nature of Relief Sought By Appellants.

The trial court fundamentally erred in evaluating Appellants' requested relief. In the "Analysis" Section of the trial court's opinion, the court stated:

> While plaintiffs have not amended their complaint, plaintiffs apparently are no longer seeking judgment to require the State to retrofit all DREs with a VVPAT. Instead, plaintiffs now seek an order to decommission the AVC and to require the State to purchase precinct-based optical scan voting machines in all twenty-one counties.

(Gusciora, slip op. at 164 (Law Div. Feb. 1, 2010); Pa305.) The trial court's assertion, however, is incorrect. Appellants' Complaint contains four prayers for relief. Appellants' four requests were, and continue to be:

> I. To enjoin the use of DREs for the upcoming November 2004 election;[30]
>
> II. To require all DREs be retrofitted to provide a voter verified paper ballot after the November 2004 election;
>
> III. To require that all new DREs purchased in the state require a voter verified

[30] Appellants' first request is, of course, moot at this stage in litigation.

paper ballot, produced using the "Mercuri Method[31];

IV. To grant reasonable attorney's fees and costs to Plaintiffs pursuant to N.J.S.A. § 10:6-2 (2004).

(Pltf's Cmplt., p. 45; Pa45). The trial court correctly stated that the Appellants' Complaint has never been amended, but the trial court erred in finding that Appellants are no longer seeking an order requiring the Appellees to retrofit the DREs with VVPATs. Appellants have never abandoned their original prayer for relief. For seven years, Appellants have asked the trial court to order Appellees to replace the Sequoia DREs with voting machines that meet the requirements of N.J.S.A. 19:48-1, the voter-verified paper ballot legislation. (Most recently, Appellants did so in Plaintiffs' Proposed Conclusions of Law, pp. 175, 179.)

While it is true Appellants' experts have maintained that a precinct-based optical scanner device is the optimal form of

[31] The "Mercuri Method" is the technique that has been devised by computer scientists in order to ensure that a computer has registered votes accurately. As described in Plaintiffs' Complaint, the Mercuri Method "calls for a paper ballot the size of a lottery ticket to be displayed behind a transparent window. The voter's choices are printed on the paper ballot. That card is available for the voter to visually inspect. If the choices printed on the ballot reflect the voter's intent, then the voter casts her vote. The paper ballot then falls into a bin in the machine. The paper ballot is preserved and can be recounted in the event of a recount or contested election. If the ballot does not reflect the voter's choice, the voter can contact the poll worker to report the discrepancy." (Plaintiffs' Complaint, ¶ 7; Pa3-4.)

voter-verified paper ballot, (Appel Test., 2/4 Trial Tr. at 101:3-18, 102:3-24; Appel Test., 4/14 Trial Tr. at 32:5-17, 30:13 to 31:22; Appel Report, § 67.2, at 140; Ex. P-2; Pa671), Appellants have never abandoned their request for the voter-verified paper ballot described in their Complaint as the Mercuri Method. Appellants have consistently maintained, through the testimony of Prof. Appel, that the voter-verified paper ballot is the only current commercially available technology which achieves software independence, and ensures the accuracy of any computer-based voting system. (Appel Test., 4/14 Trial Tr. at 30:16 to 31:4; see generally Appel Report, §§ 66-67, at 139-42; Ex. P-2; Pa670-73.) Indeed, Appellants presented evidence of three commercially available forms of voter-verified paper ballot: (1) hand counted paper ballots; (2) optical-scan ballots counted by computer; and (3) paper ballots printed by an attached printer. (Appel Test., 4/14 Trial Tr. at 30:16 to 31:4; Appel Report § 67.1 at 140; Ex. P-2; Pa671.)

The trial court's mischaracterization of Appellants' claim for relief is just another example of her fundamental misunderstanding of the critical issues in this case. Had the trial court correctly assessed Appellants' prayer for relief, she may have evaluated Appellants' claims more effectively and issued a different and more appropriate order.

In light of the trial court's erroneous conception of the relief sought by Appellants as an underlying premise of the trial court's opinion, Appellants respectfully request that the Court reverse the trial court's judgment and exercise its authority to order the State to comply with the voter-verified paper ballot requirement.

II. WHEN REVIEWING MIXED QUESTIONS OF LAW AND FACT, THIS COURT HAS AN EXPANDED SCOPE OF REVIEW AND HAS THE AUTHORITY TO ISSUE NEW FINDINGS WHERE THE TRIAL COURT'S CONCLUSIONS ARE NOT LEGALLY INFERABLE FROM SUPPORTED FACTUAL FINDINGS.

The New Jersey Supreme Court has ruled that, for mixed questions of law and fact, appellate courts have authority to issue new findings where the lower court's conclusions are not legally inferable from supported factual findings. State v. Harris, 181 N.J. 391, 415-16 (2004); see also Pollack v. New Jersey Bell Telephone Co., 116 N.J.L. 28, 30 (N.J. Sup. 1935) (holding that, for mixed questions of law and fact, the judgment of the lower court is reversible when the lower court's conclusion is not legally inferable from the facts proven). "[W]here the focus of the dispute is . . . alleged error in the trial judge's evaluation of the underlying facts and the implications to be drawn therefrom,' the traditional scope of review is expanded." In re J.T., 269 N.J. Super. 172, 188-89 (App. Div. 1993)(quoting C.B. Snyder Realty, Inc. v. BMW of N.

Amer., Inc., 233 N.J. Super. 65, 69 (App. Div. 1988), certif. denied, 117 N.J. 165 (1989)).

This Court has authority to review the factual determinations of all non-jury trials and can issue its own factual findings, State v. Johnson, 42 N.J. 146, 158 (1964); see also Pascale v. Pascale, 113 N.J. 20, 33 (1988); N.J. Const., art. VI, § V, ¶ 3, and should do so in this case. That is because, when the lower court's factual findings are based upon "a determination . . . apparent from the face of the record with respect to which [the trial judge] is no more peculiarly situated to decide than the appellate court," those findings are not entitled to any special deference by this Court. State v. Brown, 118 N.J. 595, 604 (1990) (quoting Dolson v. Anastasia, 55 N.J. 2, 7 (1969)). Here, the trial court's many legal findings are based on her erroneous application of the facts and her fundamental misunderstanding of the legal significance of the facts presented by Appellants.

In the instant matter, the record is extensive. The case has been active since 2004 and this Court has already considered it twice. The record is voluminous and involves a complete evaluation of the State's DREs by Appellants' scientific experts, who are world class scientists. Appellees' expert agrees. Thus, this Court is as well situated as the trial court to review the full body of evidence. As such, the factual

evaluations of the trial court are not entitled to any special deference. Brown, supra, 118 N.J. at 604.

This Court, owing no deference to the trial court, should exercise its original jurisdiction, R. 2:10-5, as well as its expanded scope of review, In re J.T., supra, 269 N.J. Super. at 188-89, in order to correct the many factual errors underpinning the trial court's disposition of the mixed questions of law and fact presented in this case. Additionally, this Court should use its broad scope of review to correct the trial court's erroneous application of law to her already erroneous factual evaluations. Harris, supra, 181 N.J. at 415-16. Finally, this Court should reverse the trial court's judgment and grant Appellants their requested relief.

A. The Trial Court's Legal Conclusion That the State's DREs Meet Constitutional and Statutory Requirements Because "Not One Witness Presented Evidence That the AVC, Outside of a Controlled Academic Setting, Had Ever Been Hacked" Is Unfounded and Not Based on Any Evidence.

One of the key reasons that the trial court found that the State's Sequoia Advantage 9.00H DREs allegedly met constitutional and statutory requirements was because Appellants presented no evidence that any voting machine was actually hacked outside of a controlled academic setting. (Gusciora, slip op. at 170 (Law Div. Feb. 1, 2010); Pa311.) This legal determination fails to take into account uncontroverted evidence

that Appellants' experts easily hacked the only two voting machines to which they were given access in nearly five years of litigation. Since all 11,000 Sequoia Advantage 9.00H DREs are the same, each individual machine can therefore be hacked to steal votes in the same way as was demonstrated by Appellants' experts.

The trial court's finding ignores the fact that Appellants could not possibly have presented evidence that any of the other DREs were hacked, as Appellants did not have access to any other DREs. Furthermore, the court herself set the very rigid conditions for the evaluation of the only two DREs given to Appellants.

1. Appellants Were Given Access to Only Two of the State's 11,000 DREs to Examine In A Controlled Environment Designed In Detail By the Trial Court. They Therefore Did Not Have the Opportunity to Produce Evidence that Any Other DREs Used in the State Had Ever Been Hacked.

What is most unusual in the court's opinion is the Appellants presented no evidence that the State DREs were ever tested in anyway to determine their integrity. As described throughout this brief the DREs' software has never been tested for accuracy and reliability. Therefore the trial court had no evidentiary basis to support her opinion. Since the beginning of this litigation in 2004, Appellants continuously asked for access to the State's DREs to evaluate the DREs' accuracy and

reliability. After four years of litigation, Appellants were eventually given access to only two of the State's 11,000 Sequoia Advantage 9.00H systems for testing and analysis in the summer of 2008, and for only thirty days.

It took the entire thirty days for Appellants' experts to get most of the relevant codes and information from the manufacturer, despite multiple orders by the trial court for Sequoia and the State to turn those materials over to the Appellants. Sequoia haphazardly provided relevant information about their voting systems under court order, but never provided all of the materials they were required to give to Appellants. (Appel Report, § 54, at 111-14; Ex. P-2; Pa642-45.) Nevertheless, Appellants' experts devised numerous ways to hack the Sequoia Advantage 9.00H to steal votes without detection and produced a 155-page report discussing those methods.

All DREs have remained in the sole custody of the State. Appellants were never given access to any other voting machines. Thus, there is no way that Appellants could show whether any voting machines (other than the two they were given) had been hacked. The State did not provide any evidence that they conducted tests on the DREs and that the DREs had never been hacked. As such, the trial court's legal finding that there is no evidence that DREs have been hacked is not based on any sound evidence and should be reversed.

2. Appellants Presented Abundant Evidence That Showed How the State's Sequoia Advantage DREs Can Be Accessed and Hacked Without Difficulty Throughout the State.

Appellants presented evidence that showed how easy it is to gain physical access to the State's 11,000 Sequoia Advantage 9.00H DREs in order to hack them. Appellants' experts also demonstrated several ways in which any of the State's 11,000 DREs could be hacked without detection, with minimal effort. Nevertheless, the trial court erroneously concluded that the DREs could not be hacked outside of an academic setting. That conclusion ignores clear and uncontested evidence to the contrary.

a. DREs Are Vulnerable To Tampering. They Are Left Unattended in Polling Places For Up to Two Weeks Before and After Elections and Are Unsecured During Transport and Storage Prior to and After Each Election.

Appellants presented unrefuted evidence that the State's 11,000 Sequoia Advantage DREs were accessible to the public and could be tampered with readily without detection in warehouses, polling places, and while in transport. All county employees who testified – either for Appellants or the State – spoke about the many ways unattended voting machines could be accessed by those with the intention of hacking them.

From 2004 to 2008, Princeton Prof. Edward Felten took several photographs of himself in front of unattended DREs

throughout Mercer County. He took the photographs because, as a computer scientist who has worked on and studied DREs and also as a concerned citizen, Prof. Felten was worried about the security of completely unguarded DREs. (Felten Test., 2/10 Trial Tr. at 27: 18-21.)

In polling places he visited and at which he photographed DREs, the Sequoia Advantage DREs were left unattended. (Felten Test., 2/10 Trial Tr. at 16:12-13, 17:9-12; see also Exs. P-39, P-40, P-41, P-42, P-43, P-44, Pa850-55.) There were no guards in any of the buildings to keep watch over the DREs. (Felten Test., 2/10 Trial Tr. at 31:19-22.) All hallways were unlocked and accessible to the public, and no security badge or key was needed to access any of the buildings housing the DREs. (Felten Test., 2/10 Trial Tr. at 18:16-19.) Furthermore, Prof. Felten testified that no one approached him or talked to him as he was observing and photographing the unattended DREs. (Felten Test., 2/10 Trial Tr. at 24:15-18, 26:16-19.)

More disturbing is that, at several locations where Prof. Felten saw DREs, prominent signs, both outdoors and indoors, directed the public to the locations of the Sequoia AVC Advantage DREs. (Felten Test., 2/10 Trial Tr. at 46:20 to 47:13, 50:12-16.) Prof. Felten was able to follow these signs to the unattended DREs. (Felten Test., 2/10 Trial Tr. at 47:14-19.)

Witnesses for both Appellants and Appellees confirm Prof. Felten's testimony. As Appellants' own witness testified, in Ocean County, DREs are left in polling locations for one week before and after each election. (Clayton Test, 3/3 Trial Tr. at 33:12-16, 36:21-25.) County election officials do not implement any security protections over the Sequoia AVC Advantage DREs during the nearly two weeks the machines are at the polling locations. Mr. Clayton, Supervisor of the Ocean County voting machine warehouse, acknowledged that "there is no one to watch over" the DREs at polling locations, and he has never seen a surveillance video camera at a polling location, despite the fact that the DREs are, in some instances, left in a public "large, open cafeteria-type room." (Clayton Test, 3/3 Trial Tr. at 78:8-11, 77:2-10, 77:18 to 78:2.)

Similarly, in Hudson County, Penza Moving Company, an independent contractor, is hired to deliver DREs to polling places before an election and retrieve them after an election. No one signs for the DREs when they are dropped off at the polling locations. (Gentile Test., 2/23 Trial Tr. at 61:12-14.) No one is at the polling sites to receive the DREs. (Id.) Penza employees do not notify anyone in Hudson County to let the County know that Penza delivered the DREs to the polling places. (Gentile Test., 2/23 Trial Tr. at 61:6-14.) The DREs then sit unattended at the polling places for up to one week before and

up to one week after each election. (Gentile Test., 2/23 Trial Tr. at 61:23-25.) Anyone can therefore access the voting machines and execute a hack.

Additionally, 600 DREs are stored on the second and third floors of a warehouse in Hudson County. (Gentile Test., 2/23/09 Trial Tr. at 41:18-23.) There are no security video cameras installed at the warehouse entrance. (Gentile Test., 2/23 Trial Tr. at 44:3-5.) Although there is an alarm system that requires a four-digit arming code, the codes have not been changed since at least 1989. (Gentile Test., 2/23 Trial Tr. at 44:13-14; 44:6-24.) There are no overnight or weekend security guards at the warehouse when the county employees are not working. (Gentile Test., 2/23 Trial Tr. at 45:12-15.)

Likewise in Bergen County, the Sequoia Advantage DREs are transported to polling places between ten days and two weeks before each election. (Mahoney Test., 2/23 Trial Tr. at 108:20-25.) The DREs are then left at the polling places for up to two weeks after each election. (Mahoney Test., 2/23 Trial Tr. at 109:1-6.)

Furthermore, a large sign sits on top of the warehouse with the words “Bergen County Voting Machines.” (Mahoney Test., 2/24 Trial Tr. at 48:4-19.) There are no evening or weekend security guards at the warehouse. (Mahoney Test., 2/23 Trial Tr. at 89:5-6.) The back door entrance to the building has a three

digit code shared by all warehouse employees and which, at the time of trial, was last changed five years before. (Mahoney Test., 2/23 Trial Tr. at 96:21 to 97:12.) Even though each warehouse employee has a different four digit code for the burglar alarm, at the time of trial, codes had not been changed since the alarm system was installed twelve years earlier, and codes for newer employees have not changed since they were hired. (Mahoney Test., 2/23 Trial Tr. at 96:1-7.)

Appellees' own expert witness, Dr. Shamos, even testified that "insiders," that is, individuals who have access to voting machines by virtue of their employment, pose the greatest threat to election security because they have the unique ability to tamper with the DREs without having to defeat all of the security mechanisms that are in place to prevent such tampering. (Shamos Test., 3/23 Trial Tr. at 116:1-7; Ex. D-21 at ¶ 89.)

As such, Appellants presented strong evidence that any one of the State's DREs can be easily accessed and indeed could have been hacked while in transport or storage and that the hack(s) are undetectable. The trial court therefore erred in finding that absolutely none of the State's DREs had been hacked outside of a "pure academic setting." (Gusciora, slip op. at 170 (Law Div. Feb. 1, 2010); Pa311.)

b. Once Accessed, The State's DREs Can Be Easily Hacked in Ways That Cannot Be Detected.

Appellants' experts successfully demonstrated the vulnerabilities of both the software and hardware of the Sequoia Advantage 9.00H DRE by performing successful hacks on the voting machines. Prof. Appel performed a physical demonstration that consisted simply of picking the lock on the back of the DRE, unscrewing ten screws on the circuit board cover, popping one of the four legitimate ROM chips out of its socket on the motherboard and replacing it with a ROM containing fraudulent firmware. (ROIC video footage from 8/20/08 – 8/21/08, disk 4, Tape 4 at 4:28 to 11:22; Pa731) It took Prof. Appel less than seven minutes to complete the hack. (Id.)

Appellants also presented evidence that the software in the Sequoia Advantage 9.00H fails to detect fraudulent vote-stealing programs. In fact, by changing only 122 lines of code and using only common computer science skills and equipment, Prof. Appel was able to make the DRE cheat in perpetuity, in a manner that cannot be detected. (Appel Test., 1/28 Trial Tr. at 131:12-132:4. See also Exs. P-2; Pa532–727; Pa743 and P-16; Pa743.)

Prof. Appel also described several simple ways voting machines can be compromised through the use of fraudulent firmware on both the motherboards and the daughterboards. Prof. Appel explained that the firmware that controls how votes are

interpreted and added in the Sequoia Advantage 9.00H reside in ROM chips on the motherboard. (Appel Test., 1/28 Trial Tr. at 20:7-10; Appel Report, § 5.2, at 21; Pa553.) Furthermore, ROM chips are simply off-the-shelf memory chips available for purchase on the Internet for as little as $3.87 each. (Appel Test., 1/28 Trial Tr. at 87:3-5.) As such, Prof. Appel described several programs that can be written to the program ROM chips to steal votes as they are cast by counting the votes for another candidate, to wait until just before the polls close to steal votes, or to check what precinct the voting machine is in and only cheat if it is in a precinct where the attacker wants to cheat. (Appel Test., 1/28 Trial Tr. at 94:4-21, 110:16 to 111:2; Appel Test., 1/29 Trial Tr. at 74:17-23; Appel Report, § 3.3(1) at 15, § 24.2 at 69; Pa600.)

Prof. Appel explained that all a hacker needed was a basic knowledge of computer programming and computer organization readily taught at most colleges and universities that offer a degree in Computer Science or in Computer Engineering. Thus, over half a million people possess the technical skills needed to perform his simple undetectable hack. (See Appel Test., 1/28 Trial Tr. at 126:13-23; Appel Report, § 7.1, at 26.) The skills for creating fraudulent firmware are similar to creating computer viruses. The existence of tens of thousands of known

computer viruses is evidence of how common such skills are. (Appel Report, § 7.2, at 26; Pa558.)

The State's expert witness, Dr. Shamos, agreed with Prof. Appel that an insider could replace a real ROM chip with a fake chip. (Shamos Test., 3/24 Trial Tr. at 119:12-16.) Dr. Shamos also agreed with Prof. Appel that an insider could copy a real ROM chip with a ROM chip reader, in a matter of seconds. (Shamos Test., 3/24 Trial Tr. at 119:23 to 120:1.)

At trial, Appellants also showed that the Sequoia Advantage DREs can be hacked by replacing the legitimate Z80 chip with a fraudulent Z80 chip, called a VLSI. Appellants' expert witness, Prof. Wayne Wolf, testified that fraudulent Z80 chips are easy to create and that even a college junior could create a fraudulent Z80 chip using a field programmable gate array ("FPGA".) (Wolf Test., 5/11 Trial Tr. at 33:9-16.) Thousands of people in the United States, including senior-level undergraduate students and beginning graduate students, have the skills to create fake Z80s. (Wolf Test., 5/11/09 Trial Tr. at 33:9-16, 41:7-20, 51:14-52:4; Wolf Report, ¶ 32; Pa1206.) Prof. Wolf further testified, and Appellees' witness Dr. Shamos agreed, that it is "almost impossible to detect a fraudulent Z80 chip." (Wolf Test., 5/11 Trial Tr. at 23:4-18, 45:18 to 46:18, 46:19-25; Shamos Test., 3/24 Trial Tr. at 62:6-14; Appel Test., 4/16 Trial Tr. at 56:19 to 57:2.)

Additionally, Appellants submitted a proffer of these expert witnesses, after the trial court excluded Dr. Johnston's testimony about a particular hack he devised. (See Proffer of Roger Johnston, Ph.D. Pursuant to New Jersey Court Rule 1:7-3, Gusciora v. Corzine, No. MER-L-2691-04; Pa1172-88 (hereinafter "Johnston Proffer").) Dr. Johnston devised a way to hack the DRE without ever touching the software. Dr. Johnston developed a method of stealing votes from the front subpanels of the DREs. Id. This can be done on site at polling locations on Election Day or while the voting machines are left unattended at polling places. (See Johnston Proffer, Pa1172-88; Johnston Report § 9, at 32-33; Ex. P-81; Pa1099-1100.) Dr. Johnston's front panel attack can be performed remotely in "a number of different ways, including with an inexpensive microchip radio frequency receiver such as used by electronics hobbyists," in as little as twenty seconds. (Johnston Report § 9, at 33; Ex. P-81; Pa1100.) A hacker can therefore hijack a complete election on a voting machine simply by purchasing a $1 microprocessor with a battery and using radio frequency communication. (Id. at 33; Ex. P-81; Pa1100). Unfortunately, the trial court did not permit Dr. Johnston to testify about this. However, this hack is discussed at length in Dr. Johnston's expert report, which is in evidence as Exhibit P81.

The Appellees' witnesses unanimously agreed with Appellants' witnesses that hacking presents a threat to voting machine security in the State of New Jersey. (Smith Test., 3/19 Trial Tr. at 4:14-16; Shamos Test., 3/23 Trial Tr. at 95:12-15; Terwilliger Test., 3/30 Trial Tr. at 159:1-4.) In fact, Appellees presented no evidence that called into question the validity of any hacks devised by Appellants' witnesses.

It is precisely because of this invisible and perfect crime that New Jersey voters cannot be assured that their votes are being counted properly as required by Title 19 and the New Jersey Constitution. Appellants clearly showed that New Jersey's DREs can be easily hacked using any of a number of methods and that the hacking is undetectable. Appellants devised these hacks on the only two DREs they were given. These DREs are identical to the remaining 11,000 DREs in the State.

The trial court's legal conclusion that the State's DREs meet all constitutional and statutory standards because there was no evidence that any of the DREs in use had been hacked ignores all the scientific evidence presented in this case about the clear security risks facing the State's voting machines, including, specifically, the evidence illustrating that Prof. Appel's hacks were invisible.

3. The Trial Court Erred in Rejecting Scientific Evidence Produced Under So-Called "Laboratory Conditions" That the Court Herself Defined.

The trial court erred in rejecting scientific conclusions about the AVC Advantage based on science administered under "laboratory conditions" explicitly specified by the trial court herself. The conditions under which Appellants' experts examined the Advantage 9.00H DRE were not, in fact, true "laboratory conditions." Furthermore, in rejecting the scientific evidence Appellants' experts were able to produce in accordance to the court's own restrictions, the court improperly penalizes Appellants for the quality of their experts.

a. The Trial Court Improperly Rejected the Scientific Evidence Produced Under Rigid "Laboratory Conditions" the Court Herself Imposed Upon the Appellants.

The trial court has ruled, effectively, that Prof. Appel's scientific conclusions concerning the many vulnerabilities of the Sequoia AVC Advantage 9.00H should be rejected because experiments on the DREs were conducted under "artificial laboratory conditions." (Gusciora, slip op. at 193 (Law Div. Feb. 1, 2010); Pa334.) Those "artificial laboratory conditions" were explicitly devised by the trial court herself. (Protective Order; Pa361.) As such, not only were Appellants denied access to the State's DREs during the first four years of litigation, after gaining access to just two machines, Appellants were only

permitted to examine them under the onerous restrictions pursuant to an order of the trial court. (Id.)

The examination conditions, on their face, were highly restrictive, even if the Appellees and Sequoia had fully complied with them. In its May 19, 2008, Protective Order, the trial court minutely detailed the circumstances under which Prof. Appel was required to examine the AVC Advantage. The Order required that all examination "occur solely in a secure access controlled room at the Regional Operations Intelligence Center ("ROIC"). (Protective Order, at 7; Pa367.) Among the restrictions to access are "24 hour security camera surveillance of entrances and egresses," logging of entries and exits, no cell phones, and no Internet access. (Id. at 7-8; Pa367-68.) In addition, the ROIC is over a half-hour drive from Prof. Appel's office. (Appel Test., 2/5 Trial Tr., 8:24-9:6.) Prof. Felten, a Princeton University Prof. who specializes in computer security and voting machine security,[32] could not be out of reach of his young daughter for the summer. The cell phone prohibition instituted by the trial court effectively excluded Prof. Felten from participating in the examination of New

[32] In November 2010, Prof. Felten was appointed Chief Technologist for the U.S. Federal Trade Commission. He also serves as Director for the Center for Information Technology Policy at Princeton University.

Jersey's DREs altogether. (Appel Test., 2/5 Trial Tr. at 9:6-10.)

It is highly problematic for the trial court to have ordered strictly controlled circumstances for scientific analysis, and then to penalize the Appellants for following her very order. The trial court is, effectively, calling into question the evidentiary value of scientific findings made under her own direction.

b. The Conditions Devised By The Trial Court Were Not, In Fact, "Laboratory Conditions."

The phrase "laboratory conditions" grossly misrepresents the actual conditions under which Prof. Appel and his team analyzed the AVC Advantage. The trial court describes these conditions as "unfettered access to two AVC machines and the source code, for a period of one month." (Gusciora, slip op. at 193 (Law Div. Feb. 1, 2010); Pa334.) Neither of those descriptions is supported by the evidence.

In actuality, Prof. Appel and his team had to work in a state storage facility under an extremely restrictive protective order. Far from having "unfettered access" for "one month," Appellants' experts were never given all of the source code and other materials the trial court ordered Sequoia to produce.

Further, Appellees never provided the source code to the daughterboard. (Appel Test., 2/4 Trial Tr. at 91:3-22; Appel

Report, § 54.10, 113-14; Pa644-45.) In fact, Appellees claimed they did not even know what was actually running on the daughterboard. (Appel Report, § 54.12, at 114, Pa645.) Additionally, the AVC Advantage daughterboards ceased functioning during the examination, and Appellees refused to replace them.

As well, the use of the phrase "academic setting" to describe the testing at the ROIC inaccurately characterizes the actual circumstances. In a true "academic setting," Appellants' experts would have had actual unfettered access, without supervision, would have been able to contact colleagues by cell phone and the Internet without restriction, and would have had unlimited access to academic and laboratory equipment on a moment's notice.

By contrast, Prof. Appel and his team did their work in a spartan storage facility under highly restrictive security measures. The Protective Order required the videotaping of any "anomaly" which Prof. Appel would include in the expert report. (Modified Protective Order, June 20, 2008 ¶ 12; Pa378.) The Order also required forty-eight hours advance notice to Appellees and to Sequoia before such videotaping could occur. (Id.; Appel Test., 2/5 Trial Tr. at 10:2-13:16.)

The characterization of the Spartan conditions under which Appellants' expert worked as "laboratory conditions" is completely inaccurate and not based on any evidence.

c. The Trial Court Improperly Penalized Appellants for the Quality of Their Scientific Team.

Despite the severely restricted conditions of the examination, Appellants' world-class scientific team, led by Prof. Appel, was able to perform a substantial amount of actual scientific research. Yet, the trial court improperly penalized Appellants for the high quality of their experts, noting that "[i]t has taken world-renowned security experts substantial time to perpetrate such hacks in a laboratory setting." (Gusciora, slip op. at 172 n.86 (Law Div. Feb. 1, 2010); Pa313.)

This seems to penalize the Appellants for having highly qualified experts. Indeed, the trial court disregarded the opinion of these very "world-renowned security experts" whose own students could replicate the same hacks. (Appel Test., 1/28 Trial Tr. at 136:6-137:10; Wolf Test., 5/11 Trial Tr. at 34:4-8.)

For example, Prof. Appel testified that anyone with the equivalent of a bachelor's degree in computer science would have the capability to design fraudulent firmware. (See Appel Test., 1/28 Trial Tr. at 126:13-23; Appel Report, § 7.1, at 26; Pa558.) Notably, Prof. Appel was taught by one of his own students how

to pick the lock used on the Sequoia Advantage DRE in just seven seconds. (Appel Test., 1/28 Trial Tr. at 79:12-19.)

Prof. Wolf testified that even the slightly more difficult hack of designing a fraudulent Z80 CPU would take one of his college junior students fifty-six hours or less. (Wolf Test., 5/11 Trial Tr. at 34:4-8.) Finally, Dr. Johnston, founder and senior engineer of a vulnerability assessment team at Argonne National Laboratories, which is considered one of the best in the world, testified that any of his team members could perform the same defeats he did in court, only much quicker (since his experience is in devising attacks, rather than physically performing them). (Johnston Test., 4/21 Trial Tr. at 20:15-24; 146:24-147:14.)

B. The Trial Court's Legal Conclusions That the AVC Advantage Meets Statutory and Constitutional Standards and That the State Has Had Fifteen Years of Successful Elections Are Unfounded and Not Based on Any Evidence.

The trial court erred in concluding that "absent purposeful and criminal intrusion by an outsider or insider, the AVC records votes cast and produces accurate results" and then asserting that "claims regarding security risks of the AVC are not consistent with the State's over fifteen year record of successful elections using [the Sequoia Advantage system]." (Gusciora, slip op. at 170 (Law Div. Feb. 1, 2010); Pa311.) The

trial court's legal conclusions are not based on any evidence presented in the case.

Indeed when a Sequoia Advantage DRE misattributed votes in a Cumberland County election, on June 7, 2011, Judge Krell, who overturned the election and ordered a new one, made that very point. In response to the Attorney General's assertion that "of all the elections that occurred on June 7, none of them had [a] problem." Judge Krell stated on the record that "we have no way of knowing" that all the other elections that occurred did not have a problem because no evidence was presented that any of the other DREs used in other elections had been tested for accuracy. (Zirkle, 9/1/11, Trial Tr. at 38:12-39:1; Pa1710.) In doing so he specifically disagreed with Judge Feinberg's findings that the State had fifteen years of "successful" elections. His comments point out there is really no way of knowing this to be true. (The Zirkle case and its relation to this appeal will be discussed more fully below in Section VB of the "Legal Argument" Section of this Brief.)

As discussed throughout this Brief the only evidence presented in this case concerning the security and accuracy of the DREs was that presented by the Appellants. Appellants showed that the Sequoia Advantage is easily accessible to the public, and that it can be hacked anywhere by persons with basic computer skills.

Appellees presented no evidence that the DREs have counted votes properly for fifteen years. No witness testified about successful elections conducted in New Jersey. No witnesses testified about the DREs being reliable or accurate in any way. To the contrary, Appellants demonstrated the ease of creating a vote stealing program for the Sequoia Advantage 9.00H that is undetectable and that steals votes for perpetuity. Appellees' expert witnesses acknowledged that no test is conducted in New Jersey to determine the legitimacy of the firmware in the AVC Advantage. (Shamos Test., 3/25 Trial Tr. at 14:6-17.)

Appellees' own expert witnesses also testified that they never examined any of New Jersey's 11,000 Advantage 9.00H DREs for signs of hacking. Dr. Shamos admitted that he did not examine or test the source code, firmware, or hardware of the AVC Advantage 9.00H, nor did he research the Appellees' proposed security seals. (Shamos Test., 3/24 Trial Tr. at 104:13-17, 103:21-24.) Furthermore, Appellees' other expert witnesses, Mr. Terwilliger and Mr. Smith, testified that they performed no tests, experiments, or measurements in connection with the assertions made in the Sequoia Response report. (Smith Test., 3/19 Trial Tr. at 39:6-17; Terwilliger Test., 3/30 Trial Tr. at 114:12-18.) Without an informed physical inspection of the equipment at issue in this litigation, Appellees were unable to show that the State's DREs are secure and reliable.

Appellants also showed at trial that no effective protocol currently exists (or ever existed) to determine whether a DRE has been tampered with. (Johnston Test., 4/21 Trial Tr. 171:20-172:22.) The State made clear that it has no definite plan concerning security measures it will use in the Sequoia AVC Advantage DREs in the future, nor has the State finalized a list of security measures.[33] (Giles Test., 3/3 Trial Tr. 174:6-19.) In fact, until the last day of trial the State was still proposing new security measures. (Id.)

The trial court's assertion that the State had fifteen years of "successful" elections is thus unfounded. Appellees presented no evidence whatsoever that any of the 11,000 DREs in the State have ever been tested for fraud, that the software that runs the DREs has never been compromised or that it had a protocol in place to test for or detect hacking.

With no way to determine whether a DRE has been hacked and with no evidence of any security protocol to secure the DREs, the trial court's conclusion that the State has had fifteen years of successful elections is baseless. The trial court failed to recognize the evidence that showed it is impossible to

[33] The State has not actually purchased any security measures; has not sent out any Requests for Proposal to vendors; and cannot say with certainty which security measures, if any, it will actually use in future elections. (Giles Test., 3/3 Trial Tr. 174:6-19.) (See generally, 7/29/10 Giles Cert.; Pa391.)

distinguish between a legitimate election and one that has been compromised by an undetectable hack. The trial court disregarded the overwhelming evidence that the State's voting machines have been and remain vulnerable to be manipulated to steal elections. As such, the trial court had no basis for her conclusions.

C. The Court's Legal Conclusion That the Sequoia Advantage 9.00H Satisfies Title 19's Requirement Is Not Based on Any Evidence as the Software for That DRE Has Never Been Tested.

The court erroneously relied on the 1994 testing of the Sequoia Advantage DREs under the Federal Election Committee's (FEC) 1990 standards, and the performance of the Pre-LAT test to conclude that the DREs meet the statutory requirement that they are "thoroughly tested and reliable." See N.J.S.A. 19:48-1a. The trial court stated:

> Based on the court's review of the entire record, the court is satisfied that, in the interim, the wise and prudent decision is for the State to continue to use the AVC. First, in 1994, the AVC was successfully tested to the 1990 VSS and has been successfully used for over fifteen years in hundreds of municipal, county and state elections. Moreover, to ensure its accuracy and reliability, several testing procedures are required before an AVC voting machine is used in an election. This includes maintenance diagnostic procedures, set-up diagnostic procedures and Pre-LAT testing. For purposes of this record, it is noted that no vote count has been changed as a result of a recheck nor has any election been overturned due to a machine

> malfunction. (Gusciora, slip op. at 201 (Law Div. Feb. 1, 2010) (emphasis added); Pa342.)

In making the above characterization, the trial court concluded that the State's DREs were thoroughly tested in 1994, and that they continue to be tested before every election via the "Pre-LAT", or "pre-election logic and accuracy testing" mode, test. Both of these findings are untrue and are unsupported by the evidence presented at trial. The trial court ignored overwhelming evidence from both Appellants' and Appellees' witnesses, including expert witnesses, that the 1990 standards and the Pre-LAT tests are irrelevant for computerized DREs because those tests do not examine software in any way, and do not detect fraudulent systems.

Moreover, the recent events in the Zirkle litigation in Cumberland County, where a Sequoia Advantage DRE misattributed votes, have proven the trial court wrong (see Section V of the "Legal Argument" Section of this Brief). In that election, Pre-LAT tests were conducted. Not surprisingly, and in keeping with the scientific evidence presented by Appellants in this case, the Pre-LAT test did not catch a programming error. (Zirkle, 9/1/11 Trial Tr. at 32:22-33:2; Pa1707.) As a result, the losers of the election were declared victors, and the Zirkles lost the election. Judge Krell who overturned the June 2011 election and ordered a new one stated, "We have a lack of proper

procedures or incompetence in doing the Pre-LAT test that would have picked up a mistake by the administrator in the programming under the WinEDS." (Zirkle, 9/1/11 Trial Tr. at 37:6-9; Pa1709.) This illustrates that Pre-LAT tests are irrelevant for DREs because they do not detect fraudulent programs or programming errors that cause the Sequoia Advantage 9.00H to misattribute votes.

1. The Trial Court's Legal Conclusion Disregards Overwhelming Evidence That Voting Machines That Meet 1990 Federal Standards Do Not Meet Title 19's Statutory Requirements for Testing or Reliability.

Although called voting machines, the Sequoia Advantage 9.00H DREs are not machines at all. In fact, there is nothing mechanical about them. As Prof. Appel's expert report and testimony makes clear, the Sequoia AVC Advantage 9.00H is a computer with a user interface, such as a touch screen or a panel, which stores votes electronically during an election and can communicate election results electronically at the end of the day. (See Appel Test., 1/27 Trial Tr. at 104:24 to 106:20-25; Appel Report, § 2.1, at 9; Pa541.) The voter interface in the Sequoia Advantage 9.00H DRE provides a false sense of security. (Appel Test., 1/28 Trial Tr. at 97:2-6; Appel Report, § 2.3, at 11; Pa543.) Since the Sequoia Advantage 9.00H operates via software, unless the software in the DRE is programmed properly, there is no necessary correlation between

pressing a button next to a candidate's name and the DRE actually registering a vote for that candidate. (Appel Report, § 2.3, at 11; Pa543.) Because the Sequoia Advantage 9.00H is a computer, it follows a basic tenet of computer science – that a computer can be programmed to do what the programmer tells it to do, even to cheat in an election. (Appel Test., 2/5 Trial Tr. at 54:5 to 56:4; Appel Report, § 2.4, at 11; Pa543.) All of the Appellees' witnesses agreed that if fraudulent firmware is inserted into the Sequoia Advantage 9.00H it can be made to cheat in elections. (Shamos Test., 3/25 Trial Tr. at 144:12-18; Smith Test., 3/18 Trial Tr. at 193:10-14; Terwilliger Test., 3/30 Trial Tr. at 167:21-24.)

Because the Sequoia Advantage 9.00H DRE is a computer where vote counting capabilities are run by software, the integrity of the software is essential to the integrity of elections. If the integrity of the software is not known, there is no way to know if the Sequoia Advantage 9.00H DREs are counting votes as cast by the voters. Accordingly, the trial court erred in inferring that the Sequoia Advantage 9.00H DRE met statutory requirements simply because the DRE was tested to the Federal Election Committee's 1990 standards for voting systems. The trial court ignored overwhelming and uncontroverted evidence that the 1990 standards are obsolete and irrelevant to New Jersey's voting

machines because they do not test software, and have been fully replaced twice by more stringent standards.

a. The Trial Court Erred in Finding That the Sequoia Advantage Was Appropriately Tested Because the 1990 Standards Under Which It Was Tested Do Not Test Software, Do Not Look for Software Fraud, and Are Obsolete.

New Jersey law provides that any "thoroughly tested and reliable voting machines" may be used in an election. N.J.S.A. 19:48-1(a). Additionally, while N.J.S.A. 19:48-1(a) enumerates various other criteria that a "thoroughly tested" and "reliable" voting machine must also meet, those additional criteria are secondary to the threshold requirement that a voting machine be "thoroughly tested" and "reliable."

The trial court seriously erred in concluding that the Sequoia Advantage 9.00H meets New Jersey statutory requirement of being "thoroughly tested" because they were tested under already outdated 1990 standards that do not even examine software.

The trial court spent a considerable amount of time discussing the 1990 standards and concluded, erroneously, that because the Sequoia Advantage 9.00H had been tested to the standards that those DREs met New Jersey's statutory requirements that they be "thoroughly tested" and "reliable." But, the trial court ignored overwhelming and uncontested

evidence provided by both Appellants and Appellees showing that the tests under the 1990 standards do not assess software functionality, security, accuracy, and reliability in any way. Appellees' own witnesses testified that the 1990 standards test only hardware, not software. (Woodbridge Test., 3/4 Trial Tr. at 43:12-13; Smith Test., 3/18 Trial Tr. at 92:21 to 93:3; Shamos Test., 3/23 Trial Tr. at 192-193:4.)

Under the 1990 standards, independent testing authorities (ITAs) conduct several tests on voting machines. But their tests assess only physical durability. (Shamos Test., 3/25 Trial Tr. at 167:3-13; Shamos Test., 3/23 Trial Tr. at 188:15-17; Shamos Test., 3/23 Trial Tr. at 192:2 to 193:4.) As the trial court noted, the tests for physical durability only examine whether the machine can withstand transport, including tests for shock-handling, vibration, durability and voltage stress. (Gusciora, slip op. at 74 (Law Div. Feb. 1, 2010); Pa215).

The 1990 standards do not require the ITAs to examine a DRE's software and source code, including for fraudulent software. (Shamos Test., 3/23 Trial Tr. at 192:9-193:4.) Thus the Sequoia Advantage 9.00H cannot be considered "thoroughly tested" until all of its major components have undergone relevant testing. Given that the Sequoia Advantage 9.00H DREs are computers that function exclusively through software, the

software must be tested to see if it meets Title 19's requirements. The 1990 standards do not test software at all. Thus, by definition these standards do not meet the Title 19 statutory requirements for ensuring accuracy and reliability in computerized voting machines like the Sequoia Advantage 9.00H.

b. The Court Ignored Evidence That the Sequoia Advantage DREs Have Gone Through Substantial Software Changes Since They Were Tested to the 1990 Standards, and Thus Have To Be Re-Evaluated Under New Jersey Law.

Under N.J.S.A. 19:53A-4, the Title 19 Committee is required to reexamine or reapprove any "improvement or change" which impairs the voting machines' "accuracy, efficiency, or ability to meet" the Title 19 requirements. As discussed above, the only time that the Sequoia Advantage was examined by an ITA was in 1994 under the 1990 FEC standards, which do not require any assessment of the software component. (Terwilliger Test., 3/30 Trial Tr. at 21:8-17.) The trial court failed to consider the subsequent modifications to the Sequoia Advantage after the 1994 testing and how these modifications would affect accuracy and reliability pursuant to Title 19's requirements. The trial court therefore erred in finding the Sequoia Advantage to be "thoroughly tested" per Title 19 requirements because it failed to consider evidence on whether the system software is functional and secure.

All witnesses agreed that the Sequoia Advantage DRE tested in 1994 was very different from the one in use now. (Appel Test., 2/5 Trial Tr. at 124:21 to 126:15; Appel Test., 1/29 Trial Tr. at 135:12-14; Appel Report, §§ 60.1-2, 4-12; 63.1, 51.7 and 51.2 at 130-32, 137, 106, and 107, Pa661-63, 668, 637-38; Terwilliger Test., 3/30 Trial Tr. at 21:1-5.) In particular, Prof. Appel listed ten separate changes made to the software of the Sequoia Advantage DREs between 1994 and 2005. (Appel Report § 60.2, at 130; Pa661; Appel Report § 60.5; Pa661; Appel Test., 4/14 Trial Tr. at 59:8-61:1.) Given those modifications the Appellees' witnesses agreed that the Sequoia Advantage 9.00H DREs should have been re-tested under stricter guidelines. (Shamos Test., 3/23 Trial Tr. at 190:8-12; N.J.S.A. 19:53A-4.)

Appellants' witnesses testified that the firmware in version 9.00H of the Sequoia Advantage currently used in New Jersey would not only fail under the 1990 standards, but also fail the now-obsolete 2002 federal standards, which require some assessment of voting machine software. (Terwilliger Test., 3/30 Trial Tr. at 106:2-3.) Mr. Smith, Appellants' expert, testified that while the 2002 standards contain a number of new and enhanced requirements in comparison to the 1990 standards, by contrast, more recent standards passed in 2005 have even more

up-to-date requirements for testing software.[34] (Smith Test., 3/18 Trial Tr. at 92:21 to 93:3.)

The trial court seriously misinterpreted the New Jersey legislature's intention to ensure that all active voting machines be "thoroughly tested and reliable" by relying on the 1990 standards, and by failing to take into account that the Sequoia DREs that were tested to the 1990 standards were modified significantly and, under N.J.S.A. 19:53A-4, have to be re-evaluated.

With new testing guidelines firmly in place, the trial court's acceptance and approval of the 1990 standards as sufficient for meeting the Title 19 requirements of accuracy and reliability is not based on "sufficient credible evidence." State v. Adams, 194 N.J. 186, 203 (2008).

[34] Mr. Smith, a Sequoia employee, identified at least one way in which the failure for recertification under more recent federal standards could impair the integrity of the DREs used in New Jersey. (Smith Test., 3/18 Trial Tr. at 144:13 to 145:8.) Also known as the "hashing method," Mr. Smith testified that to perform this check, jurisdictions can obtain the hash values regarding a particular piece of software or firmware "from the federal labs because they're required by the government to hash all the software that they approved." (Smith Test., 3/18 Trial Tr. at 145:9-15) However, because Sequoia has made numerous changes and additions to the 9.00H DREs' firmware since its approval by a federal lab, the State of New Jersey would not be able to obtain reliable and/or complete hash values from the federal labs for new or updated software components of the Advantage 9.00H, to the extent that those components were not examined and approved as part of the federal certification process.

2. The Trial Court Erred in Failing To Consider Unrefuted Evidence That ITA Testing and Reporting Are Biased, Ineffective, and Deficient.

The trial court, in accepting the 1994 ITA report from Wyle Laboratories and in finding that the Sequoia Advantage was "successfully [tested] to be reliable under the 1990 federal guidelines as so certified by Wyle [Laboratories]," completely ignores the overwhelming evidence provided by both Appellants' and Appellees' witnesses on the unreliability of ITA testing and reporting. (Gusciora, slip op. at 168 (Law Div. Feb. 1, 2010); Pa309.) Appellees' expert witness Dr. Shamos has criticized ITA tests for many years. (Shamos Test., 3/23 Trial Tr. at 187:22-25.) Importantly, Dr. Shamos testified that ITA tests are ineffective, arcane, and deficient. (Shamos Test., 3/23 Trial Tr. at 187:14-15, 187:19; Shamos Test., 3/25 Trial Tr. at 165:19.) In a 2004 Congressional hearing, Dr. Shamos even demanded that a new federal voting machine testing system be created from scratch. (Shamos Test., 3/23 Trial Tr. at 189:13-17.)

As the State's own expert, Dr. Shamos, testified, under the 1990 FEC guidelines, vendors can choose the ITA that will test their DREs. (Shamos Test., 3/23 Trial Tr. at 191:18-23.) In choosing ITAs, vendors create an incentive for ITAs to satisfy vendors rather than serve the public interest. (Shamos Test.,

3/23 Trial Tr. at 192:2-5.) Furthermore, ITAs are not federal agencies and are paid by vendors. (Shamos Test., 3/23 Trial Tr. at 188:3, 191:9-10.) Dr. Shamos testified that the process of ITA compensation creates public suspicion. (Shamos Test., 3/23 Trial Tr. at 168:2-7.)

Dr. Shamos and Appellants' expert witness Prof. Appel both agreed that the ITA tests are ineffective. Dr. Shamos testified that ITAs frequently approve DREs that are not qualified to be used in an election. (Shamos Test., 3/23 Trial Tr. at 188:4-17.) For example, the last testing done by an ITA failed to identify the option switch bug and the buffer overflow bug in the Sequoia DREs, which caused dozens of people to be disenfranchised in New Jersey. (Shamos Test., 3/24 Trial Tr. at 116:1-7 and 118:13-22.)

3. The Trial Court Ignored The Fact That Election Laws of New Jersey Clearly Intend To Ensure the Security of the Electoral Process.

While some sections of Title 19 may be outdated, such as sections relating to the certification process, the Legislature's intent to secure the franchise remains clear throughout. It is this legislative intent which the trial court arbitrarily chose to ignore.

A survey of Title 19 shows the following provisions, each pertaining to the security of some aspect of the electoral

system: N.J.S.A. 19:6-9.1 (requires securing of ballot boxes); N.J.S.A. 19:8-12 (requires at least three locks for ballot boxes); N.J.S.A. 19:19-7 (mandates security of election results information); N.J.S.A. 19:31-31,32 (requires that voter registration system to be secure and accurate); N.J.S.A. 19:32-11,34 (mandates securing of ballot boxes); N.J.S.A. 19:52-6 (establishes procedure for storage of irregular ballots for examination by court); N.J.S.A. 19:52-7 (requires security procedures for keys to voting machines); N.J.S.A. 19:53B-1(a), 19:53B-20 (mandates numbered security seals for emergency ballot boxes); N.J.S.A. 19:52-1, 19:53C-1(a)(1) (mandates numbered security seals for provisional ballot bags); N.J.S.A. 19:53C-4 (mandates security screens for area in which voters fill out provisional ballots); N.J.S.A. 19:53C-10 (describes security procedures for provisional ballot bags); N.J.S.A. 19:59-10, 19:59-15(b),(c)(enacts security procedures for handling certain absentee ballots); N.J.S.A. 19:61-9 (establishes an audit team to use scientifically sound methods of auditing elections for validity using voter-verified paper ballots).

As such, the trial court ignored the Legislature's overall concern for security in Title 19 and arbitrarily limited the statutory requirements of "thorough testing" and "reliability" to what is minimally required under the 1990 FEC standards. The trial court completely disregarded probative evidence showing

the increasing importance of software security as an essential element of reliability.

4. The Trial Court's Findings Hinder All Future Evaluations of Voting Machines.

The trial court rightfully found that "enhancements [and] modifications [of the AVC Advantage] should be evaluated by a newly-constituted Title 19 Committee," but the trial court subsequently failed to address with specificity the testing standards that should be used by the Committee. (Gusciora, slip op. at 170 (Law Div. Feb. 1, 2010); Pa311.) Such a failure emasculates the rigor of any future evaluation of the State's voting machines.

The trial court's findings allow the Committee to apply the obsolete 1990 standards.[35] The language used by the trial court

[35] In a letter to the trial court, dated February 25, 2010, Appellants requested that the trial court specify the standards by which the newly-constituted Title 19 Committee ought to evaluate the Sequoia Advantage 9.00H. The trial court failed to incorporate Appellants' request in its order dated March 8, 2010. Specifically, Appellants requested:

> that the Court require the Title 19 Committee to examine the Sequoia Advantage Version 9.00H DRE using the 2007 Federal Standards. Those standards are the most current, and guarantee that the State's DREs will be evaluated by criteria that have been approved by the Federal Election Commission as adequate for determining whether electronic voting machines are safe and secure for use. Anything short of analysis under the 2007 standards would not provide adequate evaluation of the hardware and software of the State's DREs, and cannot ensure that the votes of New Jerseyans are being counted as cast.

in her opinion, and in the order, demonstrates her acceptance of the 1994 ITA report (using the 1990 FEC standards) as a successful test of the Sequoia Advantage 9.00H. The trial court's language appears to be an endorsement of the obsolete 1990 standards. (Indeed, as is discussed in Section IV of the "Legal Argument" Section of this Brief, the Title 19 Certification Committee that evaluated a Sequoia DRE after the trial was guided by the 1990 standards and never examined the DREs' software.)

As noted earlier, both Appellants' and Appellees' witnesses agree that the 2005 standards are much more stringent than the 1990 standards and that New Jersey should use the more stringent standards in the interest of both security and accuracy. (Shamos Test., 3/23 Trial Tr. at 178:3-12, 199:17-21, 187:2-3.) The trial court therefore erred by not ordering the new Committee to use federal standards that require the software and firmware to be tested in making its recommendations concerning the continued use of the Sequoia DREs. This is especially significant since the software in the Sequoia Advantage and its subsequent ten modifications and enhancements have never been tested. (Appel Report §§ 60.2, 60.5; Pa661; Appel Test., 4/14 Trial Tr. at 59:8-61:1.)

(Appellants' Letter, Feb. 25, 2010.)

Ironically, the trial court acknowledged the appropriateness "for a state to rely on federal test results in determining whether an update to an already certified voting system requires full recertification." (Gusciora, slip op at 169 (Law Div. Feb. 1, 2010); Pa310.) Yet, without testing the Sequoia Advantage DRE under more recent standards, the trial court is essentially allowing the Title 19 Committee to rely on results from obsolete federal testing standards in deciding whether recertification is needed.

Indeed, as will be discussed more fully below, using the trial court's March 8, 2010 decision as a guide, the newly constituted Title 19 Committee did not conduct a thorough inspection of the Sequoia Advantage voting machines. In fact the DRE they inspected was the wrong DRE, an outdated model, the Sequoia Advantage 9.00G. (4/28/10 Title 19 Hr'g at 35:20-21; Pa1399.) Moreover, the new Committee did not examine a single line of the programming or source code or machine code, did not examine a single document describing the internal architecture of the AVC Advantage, and made only the most superficial physical inspection of the machine. (8/27/10 Appel Cert. at ¶ 2; Pa1615.) Further, the Committee also did not examine the AVC Advantage for known memory issues, a central issue to this litigation. (See generally 4/28/10 Title 19 Hr'g.; Pa1370)

This laxity was permitted by the trial court's ruling, which did not require the Committee to adopt a more stringent standard of review; a standard of review requested by the Appellants that would require the Title 19 Committee to test the software. Only such a review would enable the Title 19 Committee to determine whether the State's voting machines satisfy Title 19's requirements that voting machines be thoroughly tested and accurate.

5. The Trial Court Ignored Evidence That the Pre-Lat Test Does Not Test for Accuracy, Reliability and Fraud.

The trial court erred significantly in stating, "to ensure its accuracy and reliability, several testing procedures are required before an AVC voting machine is used in an election. This includes maintenance diagnostic procedures, set-up diagnostic procedures and Pre-LAT testing." (Gusciora, slip op. at 201 (Law Div. Feb. 1, 2010); Pa342.) In fact, all of the evidence presented at trial suggests the exact opposite.

a. Pre-LAT Tests Do Not Detect Fraud.

All witnesses for both Appellants and Appellees testified that the Pre-LAT test does not test for fraud and does not test the Sequoia Advantage 9.00H's software. Appellees' expert witness, Dr. Shamos, agreed with Appellants' expert Prof. Appel that the Pre-LAT test is not intended to, and does not, detect fraudulent firmware. (Shamos Test., 3/24 Trial Tr. at 72:3-6.)

Mr. Terwilliger, another of the State's experts, also testified that he agrees with Prof. Appel's assertion that fraudulent firmware could be present on a machine but may not be detected during a Pre-LAT test. (Terwilliger Test., 3/30 Trial Tr. at 167:21-24.) The undisputed fact that the Pre-LAT does not detect fraud was left out of the trial court's opinion analyzing the safety and reliability of the state's DREs. (Gusciora, slip op. at 66-67 (Law Div. Feb. 1, 2010); Pa207-08.)

The trial court erroneously relied on the fact that Pre-LAT tests are conducted to reach the unsupported conclusion that the DREs are tested and reliable pursuant to New Jersey statutory requirements. N.J.S.A. 19:48-1a. One of Appellees' experts, Mr. Smith, admitted that although Sequoia has been aware that fraudulent firmware can be designed so that it will escape detection by the Pre-LAT tests performed in New Jersey, Sequoia has never notified any New Jersey state or county officials of this problem. (Smith Test., 3/18 Trial Tr. at 194:7 to 195:2.)

Furthermore, in reaching her conclusion that the Pre-LAT test ensures DRE accuracy and reliability the trial court ignored Prof. Appel's testimony that the Sequoia Advantage DREs could be made to cheat, and the cheating would not show up during a Pre-LAT test. Prof. Appel designed a very simple 122 line program to steal votes in a Sequoia Advantage 9.00H. (Appel Test., 1/28 Trial Tr. at 85:20-25; Ex. P-16; Pa743.)

That simple program can instruct the DRE not to cheat in Pre-LAT mode, but to cheat in the official election mode. (See Appel Test., 1/28 Trial Tr. at 82:5-9; Appel Report, § 4.2, at 16; Pa548.)

That is because the Advantage 9.00H DRE stores in its memory an indication of whether it is in Pre-LAT or Official Election mode. (Appel Test., 1/28 Trial Tr. at 92:22 to 93:5.) Prof. Appel's fraudulent firmware was able to take advantage of this feature, so the fraudulent firmware "knows" whether it is in Pre-LAT or Official Election mode. (Appel Test., 1/28 Trial Tr. at 92:22 to 93:9.) Thus, it avoids stealing votes during Pre-LAT testing. (Appel Test., 1/28 Trial Tr. at 93:6-16; Appel Report, § 4.2, at 16.) Prof. Appel's fraudulent firmware only steals votes during Official Election mode. (Appel Test., 1/28 Trial Tr. at 92:19-21; Appel Report, § 4.2, at 16; Ex. P-2; Pa548.)

Prof. Appel demonstrated this in Court, as well as on videotape. (Appel Test., 1/28 Trial Tr. at 103:13-22, 107:16 to 108:21; DVD 4 Tape 4, at 4:28 to 11:22, 13:13 to 14:12, 14:12, 25:34 to 34:58; Pa731; Ex. P-20; Pa747-49; P-21; Pa750-52.)

The trial court erred significantly in finding that the Pre-LAT tests are meaningful tests. The trial court erroneously failed to consider the unanimous testimony by both Appellants' and Appellees' experts that the Pre-LAT test does not detect

fraud. The trial court's mischaracterization of the Pre-LAT test as one of several tests used "to ensure its accuracy and reliability" is incorrect. Accordingly, this Court should exercise its original jurisdiction to find that the State cannot continue to constitutionally use the Sequoia Advantage DREs without a VVPAT.

b. The Current Pre-LAT Testing Procedures Are Not Uniform and Are Admittedly Not Intended to Detect Fraud.

Further elevating the significance of the Pre-LAT test, the trial Court based her conclusions on the testimony from election officials in only three New Jersey counties, none of whom is an expert in computer security. Notably, Mr. Giles, the Director of the New Jersey Division of Elections, testified that the State does not mandate a uniform procedure for conducting Pre-LAT tests. (Giles Test., 3/3 Trial Tr. at 154:3-11.) This means that each county is left to design, and conduct, their own Pre-LAT testing procedures without oversight from the State.

The trial court ignored the individual problems with the Pre-LAT testing procedures in these three counties. The trial court failed to consider that Mr. Clayton, supervisor of the Ocean County voting machine warehouse, testified that Ocean County's Pre-LAT test, which he designed does not ensure that the DREs will accurately tally votes. (Clayton Test, 3/3 Trial Tr. at 79:20 to 80:9.) Furthermore, Ocean County uses

simulation cartridges to conduct Pre-LAT testing. (Clayton Test, 2/26 Trial Tr. at 237:12-16, 241:10-17.) Typically, Mr. Clayton writes the simulation script to cast only between eight and fifteen votes per candidate. (Clayton Test., 3/3 Trial Tr. at 83:13-20.) Mr. Clayton testified that simulation scripts are written to test only buttons that are recommended by the WinEDS system; they do not test all the buttons on the voting machine to see if they have been tampered with. (Clayton Test, 3/3 Trial Tr. at 83:5-8.)

Moreover, and most notably, Pre-LAT tests performed in all counties, including Ocean, Union and Mercer, in preparation for the February 5, 2008 Presidential primary did not uncover the option switch bug, which allowed for a greater number of votes than voters to be recorded by the Sequoia AVC Advantage DREs, (Clayton Test, 3/3 Trial Tr. at 85:10-18; Rajoppi Test., 2/26 Trial Tr. at 70:1 to 75:15; Sollami-Covello Test., 2/24 Trial Tr. at 67:13-16.) and actually disenfranchised voters. (Appel Test., 1/29 Trial Tr. at 165:22 to 169:10; Appel Report, § 56.1, at 115; Pa646; Shamos Test., 3/25 Trial Tr. at 37:24 to 38:21; Terwilliger Test., 3/30 Trial Tr. at 120:13-122:18).

Additionally, the Pre-LAT tests in Hudson and Bergen Counties would not detect fraud because they involve casting just one vote for each candidate, contest or question on the ballot. (Gentile Test., 2/23 Trial Tr. At 48:17-24; Mahoney

Test., 2/23 Trial Tr. at 101:22-24.) If, in fact, only one vote is cast for each candidate or ballet question it would be impossible to tell if a vote was counted incorrectly since there is no way to tell the origin of that vote. Such a one-vote test does nothing to test accuracy and reliability.

The trial court also failed to note that there are insecurities inherent in the Pre-LAT examinations that render the DREs unusable. In Hudson County, neither Ms. Gentile nor her employees supervise the third-party contractor, Election Graphics, when they are conducting Pre-LAT tests at the voting machine warehouse. (Gentile Test., 2/23 Trial Tr. at 50:13-18.) The Election Graphics employees spread out in the large warehouse and at times are completely alone and unsupervised with the DREs. (Gentile Test., 2/23 Trial Tr. at 50:4-12.) Similarly, in Bergen County the warehouse mechanics, both full time and temporary hires, perform the Pre-LAT tests prior to each election. (Mahoney Test., 2/23 Trial Tr. at 90:2-3, 80:13-5, 89:8-10, 100:17-21.) Criminal background checks are not performed on any of these employees, and they can gain full unsupervised access to the building using simple codes for the alarm and the door that are rarely changed. (Mahoney Test., 2/23 Trial Tr. at 89:18-24, 91:10-14, 93:14 to 94:14, 96:1-7, 96:21 to 97:12.) The unsupervised access these employees, and contractors, are given to the DREs makes it impossible to know

what checks are being performed on what machines prior to an election.

The trial court failed to consider the insignificance of Pre-LAT testing for ensuring accuracy and reliability. Expert witnesses for the Appellants and the Appellees agreed that the Pre-LAT test does not test fraud. Indeed, as will be discussed more fully in Section VB of the "Legal Argument" Section of this Brief, Pre-LAT tests did not catch a serious programming error in June 2011 that caused a Cumberland County the DRE to misattribute votes.

Furthermore, the trial court was incorrect in her generalization of how Pre-LAT testing is conducted throughout the State. There is no State-wide standard for conducting the Pre-LAT test, and the testing procedures currently in use in two of three counties in which evidence was presented cannot possibly detect fraud since only one vote was cast for each candidate and each issue on the ballot. Thus, the Court incorrectly relied on the 1990 Standards and the Pre-LAT test as an effective means of testing the DREs for accuracy and reliability.

Accordingly, this Court should exercise its original fact finding jurisdiction to find that the State's DREs violate both Title 19's requirement that voting machines are 'thoroughly

tested' as well as the New Jersey Constitution's requirement that all votes be counted as cast.

III. FOLLOWING A NON-JURY TRIAL, THIS COURT HAS EXPANDED AUTHORITY TO MAKE NEW OR AMENDED FINDINGS OF FACT IN ITS REVIEW OF THE TRIAL COURT'S FACTUAL FINDINGS.

The New Jersey Supreme Court has ruled that "[t]here can be no doubt of the power of the appellate tribunals of this State, certainly since the Constitution of 1947, to review the fact determinations of a trial court in all cases heard without a jury and to make new or amended findings." State v. Johnson, 42 N.J. 146, 158 (1964); see also Pascale v. Pascale, 113 N.J. 20, 33 (1988). The Johnson Court further held that this power "extends equally and uniformly to every type of cause, legal or equitable, civil, criminal, and . . . a penal offense not reaching the stature of a crime." Johnson, 42 N.J. at 158-59. Therefore, the "contention that the trial court erred in its determinations of the facts, whether underlying or ultimate, may be urged on appeal in any nonjury case." Id. at 161. Such power on review is clearly enshrined in New Jersey jurisprudence. See De Baro v. Gabryelski, 14 N.J. Super. 50, 53 (App. Div. 1951) ("We are empowered to review the evidence relating to the facts and, where the controversial issue is essentially factual, we may make our own findings when in our judgment the interests of justice so require."); Sun Dial Corp. v. Rideout, 16 N.J. 252 (1954); Kievit v. Loyal Protective Life

Ins. Co., 34 N.J. 475 (1961); In re Registrant R.F., 317 N.J. Super. 379 (App. Div. 1998); In re Estate of Mosery, 349 N.J. Super. 515 (App. Div. 2002); Abeles v. Adams Engineering Co., 35 N.J. 411, 423–424 (1961).

Generally, the factual findings of a trial court are "not disturbed unless 'they are . . . wholly insupportable.'" Rova Farms Resort, Inc. v. Investors Ins. Co. of America, 65 N.J. 474, 483 (1974)(internal citations omitted). If a "review of the record 'leaves [the court] with the definite conviction that the judge went so wide of the mark that a mistake must have been made,'" the reviewing court "may 'appraise the record as if [it] were deciding the matter at inception and make [their] own findings and conclusions." C.B. Snyder Realty, 233 N.J. Super. at 69 (citing and quoting Pioneer National Title Ins. Co. v. Lucas, 155 N.J. Super. 332, 338 (App. Div. 1978)). Thus, in State v. Adams, 125 N.J. Super. 587 (App. Div. 1973), the Appellate Division found that the trial court had made a number of unsupported findings of fact. In response, the Appellate Division stated:

> We conclude that those findings were clearly mistaken ones, "so plainly unwarranted that the interests of justice demand intervention and correction," State v. Johnson, 42 N.J. 146, 162 (1964), in the exercise of our constitutional power "to review the fact determinations of a trial court in all cases heard without a jury and to make new or amended findings."

Adams, 125 N.J. at 597.

However, the Supreme Court of New Jersey has stated clearly that the factual findings of a trial court are not entitled to any special deference when those findings are based upon "a determination as to worth, plausibility, consistency, or other tangible considerations apparent from the face of the record with respect to which [the trial judge] is no more peculiarly situated to decide than the appellate court." State v. Brown, 118 N.J. 595, 604 (1990) (quoting Dolson v. Anastasia, 55 N.J. 2, 7 (1969)); see also Caldwell v. Haynes, 136 N.J. 422, 432 (1994). Thus, in contrast to the limited scope of appellate review that is applied to a trial court's findings based upon his or her "opportunity to hear and see the witnesses and get a 'feel' for the case," a trial court's factual findings with regard to matters apparent on the face of the record are squarely within the scope of an appellate court's inquiry. Johnson, 42 N.J. at 161.

In this case, the court below erred significantly in her factual findings. Nearly eight years of litigation, in addition to a five-month bench trial, has produced the voluminous and comprehensive record presently before this Court. This Court is therefore as well-situated as the trial court was at the time of trial to review the full body of evidence in this matter. The trial court's errors in this regard were in no way premised upon

her “feel” for the case, but rather upon blatant misunderstandings of the evidence presented at trial. As such, it is incumbent upon this Court to exercise its original jurisdiction, pursuant to R. 2:10-5, in order to correct the many factual errors underpinning the trial court’s judgment. It is likewise incumbent upon this Court to reverse the trial court’s judgment and grant Appellants their requested relief.

A. The Trial Court’s Legal Conclusion That the AVC Advantage Meets Statutory and Constitutional Standards Ignores the Overwhelming Consensus of the Scientific Community.

The trial court ignored evidence showing that all of the scientific experts, with the exception of the State’s expert witnesses, agree that a paper-based VVPAT is the only way to ensure the integrity of an election system. Thus, the trial court’s decision not to require the State to equip the voting machines with independent VVPATs to satisfy the statute should be reversed. Twenty-two of the twenty-five election technology experts published in “Who’s Who in Election Technology” agree that paperless DREs such as the Advantage are unacceptable. (Appel Report, § 16.9, at 52; Pa584-85.) These experts agree that computers may be used, but must be verifiable independently of the computer program. Id. These experts agree that the only available technology that combines computer technology with

software independence is an independent paper ballot. (Appel Report, § 66.1, at 139; Pa670.)

Among experts in computer security who study voting systems, software independence is considered the superior means of ensuring electoral accuracy. (Appel Report, § 66.2, at 139; Pa670.) The opinions of the State's expert are not shared by members of the scientific community. Dr. Shamos, the State's expert witness, is the only expert who supports paperless voting systems that cannot be independently audited by paper ballots. When asked if he could identify any other computer scientists or computer security experts who agreed with his position that paperless DREs are superior to DREs that produce an independent voter-verified paper ballot, Dr. Shamos named just two individuals who might agree with this position. (Shamos Test., 3/24 Trial Tr. at 83:8 to 84:17.) When further questioned about these individuals, however, Dr. Shamos admitted that they in fact supported software independence, precinct-based optical scanners, or a software independent voter-verified paper audit trail, not paperless DREs. (Shamos Test., 3/24 Trial Tr. at 109:20 to 110:3, 113:4-7.)

Therefore, because the trial court erred in ignoring that the overwhelming majority of scientific experts support the paper-based audit system, the trial court's decision should be reversed because her factual finding cannot be "supported by

adequate, substantial and credible evidence." Rova Farms Resort v. Investors Ins. Co., 65 N.J. 474, 484 (1974). Thus, as a matter of law, these Sequoia Advantage DREs should not be used in elections in New Jersey until they finally adhere to N.J.S.A. § 19:48-1(b).

B. The Trial Court's Finding That the Option Switch Bug Did Not Actually Disenfranchise Voters Throughout the State in 2008 Ignores Uncontested Evidence From Both Appellants' and Appellees' Witnesses.

The trial court failed to recognize that the option switch bug caused the loss of actual votes and the disenfranchisement of voters during the 2008 Presidential Primary election. This is in blatant contradiction to uncontested evidence presented at trial.

The option switch bug in the Sequoia Advantage 9.00H DRE surfaced in the voting machines throughout the State during the Primary. As a result of the option switch bug, a greater number of votes than voters were allowed to be recorded. (Clayton Test, 3/3 Trial Tr. at 85:10-18.) The option switch bug still exists in the software of all 11,000 of the State's DREs. (See Terwilliger Test., 3/30 Trial Tr. at 125:5-9.)

The trial court mistakenly characterized the serious option switch bug by saying that "the 'option switch bug,' occurred as the result of poll worker error." (Gusciora, slip op. at 27 (Law Div. Feb. 1, 2010); Pa168.) Additionally, when referring

to the option switch bug, the trial court stated that, "[w]hile the party tallies were off, the actual votes cast for each candidate were correct." (Gusciora, slip op. at 27, n.28 (Law Div. Feb. 1, 2010); Pa168.) This characterization gives the false impression that all votes cast were properly counted. It also gives the false impression that the option switch bug is not a serious software flaw within the DRE. Neither of these are true.

1. The Trial Court Erred in Finding That "The Actual Votes Cast For Each Candidate Were Correct" When in Truth Voters Were Disenfranchised by the Bug.

The impact of the option switch bug is that New Jersey voters were disenfranchised. All witnesses essentially agreed with Prof. Appel that the option switch bug disenfranchised voters during the 2008 Presidential Primary election. (Appel Test., 1/29 Trial Tr. at 165:22 to 169:10; Appel Report, § 56.1, at 115; Pa646; Shamos Test., 3/25 Trial Tr. at 37:24 to 38:21; Terwilliger Test., 3/30 Trial Tr. at 120:12-122:18). The option switch bug effectively prevented voters from voting in their own party primaries, which they had a right to do.

Equally disturbing, the voters were also permitted to vote in the opposite party's primary and have that vote counted. (Appel Test., 1/29 Trial Tr. at 157:14 to 158:2; 159:15- 19; 161:1-12; Appel Report, § 56.22, at 121; Pa652.)

In eight counties, the option switch bug presented Democratic Primary voters with Republican ballots. Some of those voters cast votes in the Republican primary, which is illegal under N.J.S.A. 19:23-45. (Sollami-Covello Test., 2/26 Trial Tr. at 30:25-31:12.) The option switch bug caused the DRE to present Democratic Party voters with the Republican primary ballot. (Sollami-Covello Test., 2/26 Trial Tr. at 30:25-31:12.) In those instances, several registered Democratic voters realized they could not vote for Democratic candidates so they wrote in "Hillary Clinton." Id. As Democratic voters may not vote in the Republican primary, these write-in votes were not counted. N.J.S.A. 19:23-45.) As such, the option switch bug disenfranchised some voters and allowed others to illegally vote in the wrong Primary election, but in both cases the votes cast were not "correct."

Dr. Shamos, an expert witness for the State, agreed with Appellants' expert, Prof. Appel, that the "option switch bug" purposefully disenfranchised voters by not counting all votes as cost. (Shamos Test., 3/25 Trial Tr. at 37:24 to 38:21.) Dr. Shamos also agreed with Prof. Appel that a poll worker could exploit the "option switch bug" to purposely disenfranchise voters. Id. Dr. Shamos went so far as to conclude that "the option switch bug is bad." (Shamos Test., 3/25 Trial Tr. at 37:19-23.) Sequoia's Mr. Smith, testified that even he believes

the option switch bug is “a real problem.” (Smith Test., 3/18 Trial Tr. at 129:9.)

Notably, independent testing authorities, the Title 19 Committee, and Sequoia failed to identify the option switch bug in the Sequoia DREs. (Shamos Test., 3/24 Trial Tr. at 115:25 to 116:7.)

2. There is No Evidence to Support the Trial Court’s Conclusion That the Option Switch Bug Was the Result of “Poll Worker Error.”

The trial court erred in calling the option switch bug the result of “poll worker error” (Gusciora, slip op. at 26 (Law Div. Feb. 1, 2010); Pa168.), and not acknowledging that it is a serious software bug that disenfranchised voters.

When a voter approaches a poll, the poll worker activates the DRE for the voter by pressing a button labeled with the appropriate party name, and then the Activate button. (Appel Test., 1/29 Trial Tr. at 157:14-21.) A voting machine that functions according to New Jersey law should allow a Democratic voter to vote only for Democratic candidates and Republican voter to vote for a Republican candidate. See N.J.S.A. § 19:23-45. Both Appellants’ and Appellees’ witnesses presented significant evidence that a bug exists in the Sequoia Advantage software that can manipulate that straightforward and legally mandated process. (Appel Test., 1/29 Trial Tr. at 165:22 to 169:10; Appel Report, § 56.1, at 115; Pa646; Shamos Test., 3/24

Trial Tr. at 103:10-12.) When the option switch bug is triggered, the DRE will not allow a voter to vote in the correct party primary. (Appel Test., 1/29 Trial Tr. at 157:14 to 158:2; 159:15-19; 161:1-12; Appel Report, § 56.22, at 121; Pa652.) Instead, the bug causes the DRE to activate the slate of candidates for the other party. (Id.) So, in violation of State law, a Republican is allowed to vote for a Democratic candidate in the Democratic primary, and vice versa. N.J.S.A. § 19:23-45.

The option switch bug causes the Advantage 9.00Hs to behave incorrectly when a poll worker, accidentally or deliberately, presses the wrong button on the operator panel of the DRE while activating the voting machine for a primary election. (Pls.' COL at 53.) Prof. Appel actually demonstrated for the trial court how the option switch bug can be deliberately activated. (Appel Test., 2/4 Trial Tr. at 30:7-10, 34:5-8; Appel Report, § 56.11-13 at 118; Ex. P-2; Pa649; Exs. P-25 and P-26; Pa765-67; Exs. P-3, P-4, P-5 and P-6; Pa728-31; Appel Test., 1/29 Trial Tr. at 165:22 to 169:10; Appel Report, § 56.1, at 115; Ex. P-2; Pa646.)

Nonetheless, the trial court erroneously concluded that the option switch bug was "the result of poll worker error" (Gusciora, slip op. at 27 (Law Div. Feb. 1, 2010); Pa168.) No poll workers testified at trial, and no reports or studies were introduced into evidence that support such a conclusion. While

the option switch bug can be activated inadvertently by poll worker error, Prof. Appel showed that the bug can be activated deliberately. (Appel Test., 1/29 Trial Tr. at 185:17 to 186:8; Appel Report, § 31.1, at 80; Ex. P-2; Pa611.) The trial court's conclusion ignores the very real threat that the option switch bug was, and can continue to be, deliberately activated to prevent voters from voting in their political party's primary.

As a result of the option switch bug on February 5, 2008, at least thirty-seven DREs in eight counties lost votes, or allowed Republican or Democratic voters to vote in the primary of the other party. (Appel Report, § 56.1, at 115; Ex. P-2; Pa646.) For example, in five of the nine districts in Union County, there were fewer voter authority slips than votes on the results cartridge, meaning more votes were cast than there were voters. (Rajoppi Test., 2/26 Trial Tr. at 75:10-15.) The Mercer County Clerk noticed the same erroneous results. (Sollami-Covello Test., 2/26 Trial Tr. at 19:17-20; Sollami-Covello Test., 2/24 Trial Tr. at 67:2-8, 70:1, 71:12-13; N.J.S.A. 19:23-45.) Furthermore, multiple Democrats who were presented with a Republican ballot rather than a Democratic ballot attempted to write-in "Hillary Clinton" in the Republican primary. (Sollami-Covello Test., 2/26 Trial Tr. at 30:25-31:12.) Those votes were not counted, because Democratic voters may not vote in the Republican primary. N.J.S.A. 19:23-45.

By attributing the option switch bug to poll worker error the trial court ignored that the option switch bug can cause a DRE to be maliciously manipulated to prevent voters from voting for the candidate of their choice. Such a serious software flaw makes the Sequoia Advantage DREs unreliable, inaccurate, and insecure in violation of New Jersey statutory and Constitutional Law.

3. The Trial Court Incorrectly Found That the Option Switch Bug Has Been Remediated.

In finding that the option switch bug has been effectively remediated, the trial court completely dismisses evidence to the contrary provided by both Appellants' and Appellees' expert witnesses. (Gusciora, slip op. at 193, n.96 (Law Div. Feb. 1, 2010); Pa334).

Sequoia's Mr. Terwilliger testified that Sequoia has taken no action to remediate the option switch bug in the firmware of the Advantage 9.00H DREs used in New Jersey. (Terwilliger Test., 3/30 Trial Tr. at 125:5-9; Smith Test., 3/18 Trial Tr. at 186:12-19.) Appellees' witness, Mr. Clayton, testified that to prevent the option switch bug a plastic cover attached with Velcro was added to the DREs in Ocean County to prevent inadvertent activation of the option switch bug by poll workers. (Clayton Test., 3/3 Trial Tr. at 85:19-22.) However, there are no protocols in place to ensure the plastic shield is used, and

the ease with which the cover can be detached makes it an inappropriate remediation for deliberate activation of the option switch bug. (Clayton Test., 3/3 Trial Tr. at 85:19 to 86:3-9, Smith Test., 3/18 Trial Tr. at 129:8 to 130:22.) Therefore, not only has the option switch bug caused votes to be lost, but the bug has not been remediated.

The trial court erred in ignoring the significance of the option switch bug, and erred in failing to recognize that the bug disenfranchised New Jersey voters. Furthermore, the trial court was incorrect in its generalization that the bug was a result of "poll worker error." Thus, the trial court was incorrect in finding that the State's DREs meet the New Jersey Constitution's requirement that all votes be counted as cast, which resulted in the disenfranchisement of New Jersey voters in 2008.

C. The Trial Court's Finding That Viruses Do Not Present a Legitimate Risk to the Sequoia AVC Advantage DREs Is Wholly Unsupported By The Evidence Presented.

The trial court's finding that "[v]iruses do not present a legitimate risk to the AVC" is unsupported by adequate and credible evidence. (Gusciora, slip op. at 172 (Law Div. Feb. 1, 2010); Pa313.) Appellants presented uncontested evidence of how viruses pose real risks to election results and elections as a whole. (Appel Test., 1/29 Sealed Trial Tr. at 3:15-19.) These

risks implicate the core legal issues in this case. Title 19 requires that all voting machines be secure, accurate, and reliable. Moreover, both Title 19 and the New Jersey Constitution require that all votes be counted as cast. See N.J.S.A. 19:48-1(h) ("It shall correctly register or record and accurately count all votes cast."); N.J. Const. Art. I, ¶ 2. See also In re Gray-Sadler, 164 N.J. 468, 474 (2000) ("A citizen's constitutional right to vote for the candidate of his or her choice necessarily includes the corollary right to have that vote counted at full value without dilution or discount."). Viruses introduced into the Sequoia Advantage 9.00H can alter and compromise election results in violation of the New Jersey Constitution and Title 19. Because the trial court ignored evidence showing the dangers of viruses, her judgment should be reversed.

Appellants presented evidence at trial that showed several pathways through which viruses can propagate to and from both the motherboard and daughterboard of a Sequoia AVC Advantage 9.00H. (Appel Test., 1/29 Trial Tr. at 3:2-12; Appel Report, §§ 19, 20, 21, 22, 24, and 26; Ex. P-2, P-15; Pa588-96; Pa600-01; Pa602-03; Pa740.) Appellants presented evidence that showed several ways through which viruses on the daughterboard and motherboard could spread from component to component, disenfranchising voters in the process:

- A virus can propagate to the daughterboard through the audio ballot cartridge or by the connector plug. (Appel Test., 1/29 Trial Tr. at 3:5-6.);

- A virus can propagate out from the daughterboard to the audio ballot cartridge and infect other daughterboards. (Appel Test., 1/29 Trial Tr. at 3:7-8.);

- A virus can propagate from the audio ballot cartridge to WinEDS. (Appel Test., 1/29 Trial Tr. at 3:8-9.);

- A virus can propagate from WinEDS to the audio ballot cartridge. (Appel Test., 1/29 Trial Tr. at 3:9-10.);

- A virus can propagate from WinEDS to other WinEDS computers on the same network. (Appel Test., 1/29 Trial Tr. at 3:11-12.);

- A virus could be introduced to the motherboard through a fraudulent results cartridge. (Appel Test., 1/29 Trial Tr. at 74:17-23; Appel Report, § 24.2, at 69; Ex. P-2; Pa600.) That virus could then spread to the WinEDS computer used to tabulate those votes.

1. The Daughterboard Audio-Kit in the Sequoia Advantage 9.00H is Vulnerable to Viral Attacks That Can Easily Re-Write Votes, Permanently Alter the Software, and Jump from Daughterboard to Daughterboard.

The trial court erroneously found that "[t]he viral mode theorized by Plaintiffs' expert through the use of the daughterboard is fictional." (Gusciora, slip op. at 172 (Law Div. Feb. 1, 2010); Pa313.) The judge further stated that "[t]he notion that some kinds of fraudulent firmware can automatically propagate themselves from one AVC to another is

purely hypothetical." (Id.) These findings are false and unsupported by the evidence. The threat of viruses to the Sequoia Advantage 9.00H voting machines is real and has been well documented on the record.

The Appellants provided uncontested evidence that fraudulent firmware on the daughterboard could spread from voting machine to voting machine and can affect all voters, not just disabled voters who use the audio-ballot system. Appellants presented evidence that vote-stealing malware could easily be inserted into the "audio-kit" daughterboard of the Advantage, create fraudulent votes, and steal elections. (Appel Test., 1/29 Sealed Trial Tr. at 6:20-21.) All software in the daughterboard is stored in re-writable flash memory.[36] (Appel Test., 1/28 Trial Tr. at 61:10-17; Appel Report, § 19.10, at 56-57.) Thus, the daughterboard is considerably more vulnerable than the motherboard. (Appel Report, § 19.10, at 58; Ex. P-2; Pa590.)

A virus can be introduced to the daughterboard through the audio-ballot cartridge. (Appel Test., 1/28 Trial Tr. at 7:17-

[36] Flash memory is a form of nonvolatile memory, meaning that the contents of the memory do not disappear when the computer is powered off. (Appel Test., 1/28 Trial Tr. at 60:22-24.) Therefore, fraudulent firmware which replaces the legitimate firmware on the flash memory on the daughterboard will run every time the DRE is turned on. (Appel Test., 1/29 Trial Tr. at 82:16 to 84:3.)

19, 8:8-13, 61:12-15; Appel Report, § 19.5, at 56-57; Ex. P-2; Pa588-89.) The audio-ballot cartridge is a necessary component of the AVC Advantage 9.00H's daughterboard audio-kit computer. (Id.) A legitimate audio ballot cartridge contains ballot definitions designed for use by the visually impaired.[37] These, like normal ballot definitions, include the names of candidates and contests, but instead of printed text, the ballot data is spoken out loud so it can be heard. (Id.)

Fraudulent intent is not required to spread viruses through the audio ballot cartridge to the daughterboard. (Appel Test., 1/28 Trial Tr. at 65:18-21.) Well-meaning election workers could spread a virus inadvertently while attempting to do no more than install new audio ballot data. (Appel Test., 1/28 Trial Tr. at 65:18-21.)

When an audio ballot cartridge is infected with a virus and then inserted into an AVC Advantage DRE, the virus propagates into the internal flash memory of the audio kit daughterboard. (Appel Test., 1/28 Trial Tr. at 61:10-17, Appel Test., 1/29 Trial Tr. at 3:15-19; Appel Report, § 20.6.1, at 60; Ex. P-2; Pa592.) The virus then resides in the internal memory of the daughterboard. When any uninfected cartridge is later installed

[37] The audio ballot cartridge is a PCMCIA card, a credit-card sized device which fits in a type of slot standard on a laptop. (Appel Test., 1/29 Trial Tr. at 72:17-20; Appel Report, § 19.4, at 56, Fig. 19; Pa588; P-10; Pa735.)

into that DRE (as it always is to prepare for another election and/or to receive election results), the virus copies itself onto that cartridge and that cartridge is then infected. (Appel Test., 1/29 Trial Tr. at 73:14-21; Appel Report, § 20.6.2, at 60; Ex. P-2; Pa592.)

The process to replace the firmware on the daughterboard requires no tools at all. (Appel Test., 1/28 Trial Tr. at 61:10-23; Appel Report, § 19.11, at 58; Ex. P-2; Pa590.) When a user inserts an audio ballot cartridge into the DRE, under certain conditions, the contents of that audio ballot cartridge are automatically copied into the flash memory inside the DRE, even if the contents are fraudulent firmware.[38] (Appel Test., 1/28 Trial Tr. at 61:10-17.) The user is not warned in any way of the automatic copying mechanism, thereby making it easy to substitute a malicious virus-infected cartridge for a legitimate cartridge of another type. (Appel Test., 1/29 Sealed Trial Tr. at 6:7 to 7:6, 9:14 to 11:2, Appel Report, § 19.4, at 56, Fig. 19; Ex. P-10, P-2; Pa588, Pa735.)

[38] This design provides a convenient way for Sequoia technicians to be able to upgrade firmware to the daughterboard, such as when Sequoia changed the firmware from version 9.00G to the current version, 9.00H. (Appel Test., 1/29 Sealed Trial Tr. at 6:1-6.) However, while this design might be appropriate for other embedded computer systems such as microwave ovens, it is not appropriate for use in situations where security is a relevant concern, such as in a Sequoia DRE. (Appel Test., 1/29 Sealed Trial Tr. at 7:13.)

The State's own expert witness, Dr. Shamos, agreed with Prof. Appel on the vulnerability of the daughterboards to viruses. (Shamos Test., 3/25 Trial Tr. at 31:25–32:4.) He testified that infecting the audio-ballot cartridge "is a viable mechanism of infecting the daughterboard," and that the design of the Advantage 9.00H in this regard is "outrageous." (Id. at 34:24-25, 35:4-5.) Dr. Shamos testified that the daughterboard is so completely unacceptable that it requires "immediate remediation." (Shamos Report ¶ 102, at 24; Ex. D-21.) The evidence also showed that the risks posed by viruses introduced to the daughterboard could be devastating to individual votes and the entire election.

Enormous harm can result to the entire network of Sequoia DREs and WinEDS tabulation computers within a county if a virus is introduced to the daughterboard. (Appel Test., 1/29 Sealed Trial Tr. at 7:22 to 8:21.) For example:

- A virus on the daughterboard could change the votes of disabled voters. (Appel Test., 1/29 Sealed Trial Tr. at 10-13.)
- A virus that jumped from the daughterboard to an audio ballot cartridge and then to a WinEDS computer could infect other computers on the network and it could also affect the functions of the WinEDS program, such as ballot preparation and results tabulation. (Appel Test., 1/29 Sealed Trial Tr. at 8:10-16.)
- Fraudulent firmware in the form of a virus can jump from one component of the voting

system to another. (Appel Test., 1/29 Sealed Trial Tr. at 8:2-4.)

- A virus could also selectively disable DREs in certain precincts. (Id.) An attacker may wish to only alter the votes of districts with certain political tendencies.

Fraudulent firmware installed on the daughterboard can steal votes and disenfranchise voters in a number of ways. The most significant way is that it can change the votes of those who vote by audio, that is, blind voters or any voters who request to vote using the audio kit. (Appel Test., 1/29 Trial Tr. at 74:8-16.) The fraudulent firmware can change those votes before they are sent to the motherboard for tabulation. (Id.)

The trial court, in a footnote, dismissed the significance of a virus altering the votes of visually-disabled and blind voters. The trial court stated:

> Even if this was possible, the theoretical attacks could only cause votes to be altered if they had been cast by an audio voter and could only affect the motherboard into believing the machine was in a state ready for voting, requiring it to be taken out of service. As reference, only four people voted by way of audio during the February 5, 2008 Presidential primary in Bergen County, New Jersey's most populous county.

(Gusciora, slip op. at 172, n.89 (Law Div. Feb. 1, 2010); Pa313.)

It is shocking that the trial court would downplay the statutory and constitutional rights of blind and visually

impaired voters who need the audio-ballot system to vote. There are many laws in New Jersey as well as federal laws, including the Help America Vote Act (HAVA), that mandate that at least one voting machine per polling place be accessible to the disabled. (107 P.L. 252, 301.) Moreover, Title 19 and the New Jersey Constitution require that all votes be safeguarded equally. They do not permit a lower standard of protection for disabled voters.

2. Viral Propagation Is Not "Purely Hypothetical."

The court erred in stating that "[t]he notion some kinds of fraudulent firmware can automatically propagate themselves from one AVC to another is purely hypothetical." (Gusciora, slip op. at 172 (Law Div. Feb. 1, 2010); Pa313.) Indeed, Prof. Appel was able to design a virus that could propagate through the daughterboards. (Appel Test., 1/29 Trial Tr. 87:19-21.) He was unable to demonstrate the propagation of that virus between DREs solely because the Appellants denied him access to working daughterboards. (Exs. P-22A, P-22B, P-22C, P-22D, P-22E; Pa753-62.) The daughterboards given to Prof. Appel by the Appellees were faulty and had stopped functioning during experimentation. (Id.) Despite Appellants' counsels' repeated efforts over the course of several weeks to secure daughterboards, the State and Sequoia did not provide new ones. (Id.)

In repeated letter correspondence requesting the new daughterboards, the Appellants made clear that they needed the daughterboards to demonstrate viral propagations. (Appel Test., 1/28 Trial Tr. at 49:17-51:25; see also Exs. P-22A, P-22B, P-22C, P-22D, P-22E; Pa753-62.) Those letters stated that the two available daughterboards behaved "erratically" and that without the daughterboards, Prof. Appel could not perform such demonstrations. (Id.) Furthermore, the trial court did not order the Appellees to give Prof. Appel new daughterboards.

Additionally, Prof. Appel could not demonstrate viral propagation through the Internet because, by virtue of the trial court's own orders, he did not have access to the Internet during his experiments. Appellees and Sequoia vociferously argued against allowing Prof. Appel and his team of scientists access to the Internet at the secluded examination room at State police headquarters in Trenton. As such, the court cannot justifiably dismiss the notion of viral propagation as "purely hypothetical" when Appellants were prevented from demonstrating viral infection of the DRE through the Internet.

3. Viruses from the Daughterboard Can Spread to the Motherboard and Cause Entire Precincts to Shut Down.

A virus introduced through the daughterboard can cause the motherboard to fail. The significance of unleashing this attack via a daughterboard virus is that a single person can disable

voting machines in hundreds of precincts that he chooses, without ever going near any of those DREs. (Appel Report, Section 24.2.2 at 69; Pa600.)

To attack the motherboard, an attacker programs an audio-ballot virus, replacing the audio-voting software on the daughterboards of all AVC Advantage voting machines in New Jersey. On Election Day, when each machine is turned on, one of the first things that the motherboard does is to send a message to the daughterboard saying "load the audio ballot," and the daughterboard normally responds saying "OK." However, the fraudulent daughterboard software responds with a different message, either one of the following:

- "Cannot load ballot." Then the motherboard will display an error message on the Operator Panel, and the election cannot start;
- A specially crafted message that causes the machine to reboot, in an infinite loop, or for as many repetitions as the daughterboard chooses.

In either case, the AVC Advantage will fail to start up on the morning of Election Day, or will be delayed for a chosen number of minutes. (Appel Report, § 24.5-7, at 69-70; Pa600-01.)

As Sequoia DREs fail in large numbers, long lines would form, delaying voters from casting their votes. Further, many voters, either unable or unwilling to wait for lengthy periods of time, might leave before voting. These voters would be

effectively disenfranchised. This general means of manipulating elections is well understood. In Ohio in the 2004 Presidential election, "the misallocation of voting machines led to unprecedented long lines that disenfranchised scores, if not hundreds of thousands, of predominantly minority and Democratic voters."[39] Selective disabling, instead of misallocation, could produce a similar result. (Appel Report, § 24.9, at 70; Pa601.)

Thus the trial court's conclusion that "[t]he notion that some kinds of fraudulent firmware can automatically propagate themselves from one AVC to another is purely hypothetical," is flat out wrong and unsupported by any evidence whatsoever. The uncontroverted and overwhelming evidence showed that viruses are very capable of spreading in many different ways from one DRE to the next.[40] The threat of this design is so real that the

[39] What went wrong in Ohio: The Conyers Report on the 2004 Presidential Election, ed. by Anita Miller. Produced at the request of Representative John Conyers, Jr., by the Democratic staff of the House Judiciary Committee, 2005.

[40] In fact, all votes cast on the Sequoia Advantage D-10 are particularly vulnerable to viral attack since that DRE uses the daughterboard as its main processor. A critical feature of the Advantage D-10 is that, unlike the Advantage 9.00H, the main firmware in the Advantage D-10 is on the daughterboard, which (as described above) stores its firmware in rewritable flash memory. (Appel Test., 4/14 Trial Tr. at 60:10-21; Appel Report, § 61.6, at 134; Pa665.) The consequence of this is that fraudulent firmware introduced via a virus on the D-10 daughterboard can change the votes of all voters, not just blind voters. (Appel Test., 4/14 Trial Tr. at 60:10-21.)

State's own expert witness called it "outrageous." (Shamos Test., 3/25 Trial Tr. at 34:24-25; 35:4-5.)

4. Viruses Can Cause the WinEDs Tabulation Computers to Miscount Votes.

After an election, a virus could "cause WinEDS to fraudulently miscount votes, when it accumulates the results from different precincts," casting the results of the election into doubt if they differed from the results on the results report printouts. (Appel Test., 4/14 Trial Tr. at 60:15-21.)

WinEDS would be unable, on its own, to detect the fraudulent vote totals. (See Appel Test., 1/28 Trial Tr. at 5:11-24; Appel Report, § 40.4, at 90; Pa621; §§ 41.4-41.7, at 93; Pa624.) It is unlikely that fraudulent vote totals caused by

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Even Appellees' witnesses admit that flash memory on the D-10 daughterboard is unsafe because its contents are vulnerable to being changed or overwritten. (Terwilliger Test., 3/30, Trial Tr. at 109:15-21; Shamos Report ¶ 102, at 24; Ex. D-21.) Dr. Shamos wrote in his rebuttal report that the vulnerability of the daughterboard is more severe in the D-10, where a virus can steal everyone's votes and called for an immediate remediation! (Shamos Report ¶ 102, at 24; Ex. D-21.)

Prof. Appel testified that as a result of a single WinEDS computer becoming infected with a virus from the Internet, from a fraudulent results cartridge, or from a malicious act by an "insider," every Sequoia D-10 DRE in the county could become infected through the routine use of audio ballot cartridges, without any further intervention by the attacker. (Appel Test., 1/29 Trial Tr. at 72:25 to 73:3.)

Each infected WinEDS computer would then subsequently infect any audio ballot cartridge inserted into the PCMCIA slot in the WinEDS computer. (Appel Test., 1/29 Trial Tr. at 73:10-21.)

a corrupted WinEDS would be discovered because there is no statewide policy in New Jersey for the examination of printed results reports, and results cartridges are used to determine the vote totals at the end of each election. (Giles Test., 3/3 Trial Tr. at 161:6-9; see also Appel Test., 1/28 Trial Tr. at 5:13-24; Appel Report, §41.4, at 93; Pa624.)

Thus, the trial court's finding that "[v]iruses do not present a legitimate risk to the AVC," ignored substantial evidence to the contrary which showed that viruses can affect both the daughterboard and motherboard and pose legitimate risks to election results. The Appellants provided uncontested evidence that viral firmware on the daughterboard could spread from voting machine to voting machine and can affect all voters, not just disabled voters who use the audio-ballot system. Appellees' own witnesses called this "unacceptable" and called for an immediate remediation of this feature. (Shamos Report ¶ 102, at 24; Ex. D-21.) Likewise, an attacker can easily disable DREs through the motherboard and shut down entire voting precincts on Election Day. Thus, the trial court's judgment should be reversed.

D. The Trial Court Wrongly Concluded There Was No Legitimate Security Risks with the Sequoia Advantage DRE and Did Not Take Into Account the Reality of Modern Day Elections.

The trial court wrongly discounted the Plaintiff's evidence and expert testimony which exposed legitimate security risks with the Sequoia Advantage DRE simply because the methods necessary to performing these hacks were "substantial," time consuming and complex and therefore "completely unrealistic." (Gusciora, slip op. at 172 (Law Div. Feb. 1, 2010); Pa313.) The trial court's conclusion is not supported by the evidence, and does not take into account the realities of modern day elections.

The resources contributed to political campaigns in New Jersey and across the country are immense. It is thus unrealistic, and even naïve for the trial court to find it extremely unlikely that someone would spend money and time to systematically alter voting machines to manipulate the outcome of elections in New Jersey. Money spent during the 2008 Presidential race broke records. Further, money spent on many smaller municipal races across New Jersey also broke records.

In 2008 Presidential race, over 1.1 billion dollars was spent. OpenSecrets.org, 2008 Presidential Election Statistics, http://www.opensecrets.org/pres08/index.php (last visited Sept. 21, 2010). New Jersey's citizens and businesses contributed

$28,609,653 to the 2008 Presidential campaigns of all candidates, ranking eighth out of all states for top campaign contributions. OpenSecrets.org, New Jersey Contributions to 2008 Presidential Candidates, http://www.opensecrets.org/pres08/presstatetots_cands.php?state=NJ (Last visited Sept. 21, 2010).

The state Senate recall elections in Wisconsin, which took place on August 9, 2011, shattered campaign spending records across the state. Mary Spicuzza, Wisconsin Election Spending Shatters Records, August 7, 2011, http://www.postcrescent.com/article/20110807/APC0101/108070529/Wisconsin-recall-election-spending-shatters-records. The record spending, estimated at about $40 million, on these nine recall elections, topped Wisconsin's record for state Senate and Assembly races from 2008 when candidates and groups spent 20 million on 115 elections.

In New Jersey in 2010, over 23 million dollars was raised for the 13 congressional elections. OpenSecrets.org, New Jersey Congressional Races in 2010 http://www.opensecrets.org/races/election.php?state=NJ (last visited November 2, 2010). Incumbent candidate Congressman John Adler for New Jersey's 3rd District raised over 3 million in the 2010 election. Id.

On the local level, for municipal elections across the state in 2010, New Jersey political campaigns spent a total of $12,252,253. Asbury Park Press, NJ Non-Partisan Elections See Big Spending, Sept. 9, 2010, http://www.app.com/article/CN/20100909/STATE/100909079/NJ-non-partisan-elections-see-big-spending. Spending topped $100,000 in ten different municipalities. Id. In the Newark Mayoral Election, candidates spent almost $8 million. Spending in Trenton and Paterson's mayoral elections each exceeded $1 million. Id. Spending in small non-mayoral township elections like Ocean City and Jackson Township, cracked the $100,000 mark. Id.

While most campaign money is both raised and used legally, unfortunately some individuals violate both federal and state election law to secure a candidate's victory. For example, in 2005, a Texas grand jury indicted U.S. House of Representatives Minority Leader Tom DeLay with criminal violations of state campaign finance laws and money laundering, accusing DeLay of not disclosing over $190,000 worth of fundraising money. R. Jeffrey Smith, DeLay Indicted in Texas Finance Probe, Sept. 29, 2005, http://www.washingtonpost.com/wp-dyn/content/article/2005/09/28/AR2005092800270.html. While DeLay was not charged by the U.S. Justice Department, two of DeLay's former senior aides have been convicted of violating

federal law in relation to fundraising for DeLay. New York Times Online, Times Topics Tom DeLay, Last Updated Aug. 17, 2010, http://topics.nytimes.com/top/reference/timestopics/people/d/tom_delay/index.html.

Similarly, Pennsylvania State Representative Mike Veon was found guilty under state law of fourteen offenses related to using taxpayer-paid bonuses to reward state workers for illegal campaign fundraising and other state campaign efforts. Mark Scolforo, Ex-Pa. rep Guilty of 14 Counts in Corruption Case, March 23, 2010, http://www.businessweek.com/ap/financialnews/D9EKC4981.htm

These charges highlight the lengths people will go to help ensure an election win. With a large amount of money being spent people go to great lengths, and will take illegal actions, to ensure their election.

Politicians are not the only ones who go to illegal ends to ensure electoral success. There are well-documented cases of individuals who commit election-related crimes to secure a candidate's victory without the candidate's knowledge. A New Jersey campaign worker was indicted for allegedly unsealing three absentee ballots and changing the votes, during the legislative election. Chris Megerian, Newark Campaign Worker is Indicted on Election-Fraud Charges, Mar. 23, 2009,

http://www.nj.com/news/index.ssf/2009/03/newark_campaign_worker_indicte.html.

Additionally, Essex County Freeholder Samuel Gonzalez, the husband of New Jersey State Senator Teresa Ruiz, and two other county employees were indicted by a state grand jury for election fraud in connection with absentee ballots they collected and submitted as workers for Ruiz's Senate campaign. Tom Hester, Sr., Husband of State Sen. Teresa Ruiz Indicted for Election Fraud, Dec. 1, 2009. http://www.newjerseynewsroom.com/state/husband-of-state-sen-teresa-ruiz-indicted-for-election-fraud.

In Clay County, Kentucky, eight Election Officials were found guilty of election buying, including the manipulation of electronic voting machines. Those indicted and subsequently convicted included the circuit court judge, the county clerk, and four high-ranking election officers. The criminal actions affected the outcome of federal, local and state primary and general elections in 2002, 2004, and 2006. Brad Friedman, KY Election Officials Arrested Charged with 'Changing Votes at E-Voting Machines' Mar. 23, 2009, http://www.huffingtonpost.com/brad-friedman/ky-election-officials-arr_b_177468.html.

As illustrated above the huge number of resources expended on elections exemplify why the trial court's findings that it is

unrealistic to expect a substantial amount of time and resources to be dedicated to hacking the Sequoia Advantage DRE is unsupported by the evidence. The lower court ignores the realities of how elections are conducted in the United States and New Jersey. Judge Feinberg states that the evidence of a possible attack is unrealistic and uses the lack of time and resources as a reason why these legitimate security problems will never come to fruition. (Gusciora, slip op. at 172 (Law Div. Feb. 1, 2010); Pa313.) As she held, "a Trojan horse, in which a voting machine outwardly appears to the user to be using the legitimate program, is not a trivial process" requiring the hacker to reverse engineer the source code, a process that could take months. Id.

Further, the lower court's opinion states, in a footnote, that an attack on a daughterboard is possible, but then wrongly dismisses the concern because only very few people would be affected. (Id. at 172 n.89; Pa313). However, in elections that hinge on few votes, only minor fraud would be necessary.

In 2009, the New Jersey Department of the Public Advocate released a report identifying eight New Jersey Elections "in the last year where just one vote could have been outcome-determinative, meaning it could have resulted in a different winner or different public question outcome." Every Vote Counts, A Survey of Elections Where Just a Few Votes Separate

Victory and Defeat, Oct. 8, 2009, http://www.state.nj.us/publicadvocate/public/pdf/every%20vote%20counts%202009.pdf. The report also identifies sixty-six other elections that were won with a margin of less than one percent. Id.

In the 2009 General Election for the Fourth Legislative District, which includes part of Camden and Gloucester counties there was a difference of 600 votes between one winner and the first runner up. New Jersey Division of Elections, 2009 Election Information and Results, http://www.state.nj.us/state/elections/2009_general_elecion.html (last visited September 25, 2010).

Probably the most famous of these "one-vote outcome-determinative" elections was the 2000 Presidential election which gave George Bush the electoral college votes for Florida by only 537 votes. Federal Election Commission, 2000 Presidential General Election Results, http://www.fec.gov/pubrec/fe2000/2000presge.htm (last visited September 25, 2010). The 2008 Alaska House of Representatives District 7 election was determined by just one vote. The Anchorage Daily News, Nov. 26, 2008, http://www.adn.com/2008/11/03/577002/2008-alaska-general-election-results.html.

It took eight months to determine the outcome of the 2008 Minnesota Senate election. The winner was decided after a full hand recount of every vote cast on Minnesota's paper ballot optical scan system. Senator Al Franken ultimately won his Senate seat by only 312 votes. Pat Doyle, At Last, a Second Senator for Minnesota, July 1, 2009, http://www.startribune.com/politics/national/senate/49520987.html?elr=KArksUUUoDEy3LGDiO7aiU. Most importantly, had there been no ability for a recount in Minnesota, as is the case in New Jersey, Senator Franken's opponent would have been declared the winner on the basis of what was only proven by the subsequent hand recount to be an erroneous election-night computer tally.

Thus, the lower court's conclusion that there is no serious risk to manipulation of the Sequoia Advantage DRE machine because manipulation requiresintrusion into each voting machine (Gusciora, slip op. at 173, n.92 (Law Div. Feb. 1, 2010); Pa314.)

In these close elections where only a few votes separate a winner and a loser, the most minimal election tampering can determine the outcome of an election, including the tampering of just one machine. The three ballots that the worker changed during the New Jersey legislative election would have changed the outcome of the 2008 Alaskan State Election discussed above. The 2000 Presidential Election or any number of the elections

referenced in the New Jersey Department of the Public Advocate report could have all had different outcomes if similar acts that were implemented in Kentucky were planned during these elections. And the Minnesota Senate seat would, in fact, have been given to the wrong candidate had there not been the ability to have a recount, and had the recount not taken place.

The Sequoia Advantage DRE voting computers are unable to detect fraudulent software and current security procedures in place are inadequate to allow for the detection of a breach, making the risk for election tampering possible. As the convictions described above demonstrate, there are people who are willing to perform illegal acts to secure a position in government either for themselves or a candidate. The time, money and resources exist to implement a plan to rig the Sequoia Advantage DRE machines and steal elections. As the lower court herself states, the machines are often left unattended for long periods of time and "it is not difficult to gain unsupervised access to the voting machines," making it easy for a break in to occur and for a machine to be hacked, easily going undetected. (Gusciora, slip op. at 204 (Law Div. Feb. 1, 2010); Pa345.) The trial court's conclusion that legitimate security risks are unrealistic is not supported by the evidence, and does not take into account the realities of a modern day elections.

IV. THE TRIAL COURT'S POST TRIAL FINDING THAT THE NEWLY CONSTITUTED TITLE 19 COMMITTEE'S EVALUATION OF THE SEQUOIA ADVANTAGE DREs WAS SATISFACTORY IS WITHOUT MERIT. THE COMMITTEE'S EXAMINATION WAS LEGALLY INSUFFICIENT TO JUSTIFY RECERTIFICATION.

As discussed more fully in Section IIC of this Brief, the trial court's failure to require the State to adopt more rigorous testing standards to certify the State's DREs has perpetuated the use of untested and insecure voting machines.

In her February 1, 2010 opinion, Judge Feinberg found that the Committee directed by Title 19 (the "Title 19 Committee") to certify voting machines was not qualified to evaluate computerized DREs and thus could not determine their compliance with Title 19. (Gusciora v. Christie, No. MER-L-2691-04 (Law Div. Feb. 1, 2010) (slip op. at 197-201); Pa338-42.) In order to ensure that the Sequoia AVC Advantage 9.00H met Title 19's requirements, the lower court's March 8, 2010 Order, required that "within 120 days" the Title 19 Committee to "conduct a full certification examination of the Sequoia AVC Advantage DRE system as currently configured[.]" Gusciora v. Christie, No. MER-L-2691-04 (Law Div. March 8, 2010)(Order at 3); Pa137.

The lower court further ordered that the Title 19 Committee "issue a report to the Secretary of State as to whether to recommend continued use of the Sequoia AVC Advantage in this State." Id. These provisions of the Court's March 8, 2010

Order track Title 19's language, which requires essentially the same process. N.J.S.A. § 19:48-2.

Contrary to Appellants' repeated requests, the trial court did not require that the Committee examine the DREs software. Instead the trial court gave her seal of approval to the continued use of 1990 testing standards that are completely obsolete and do not test software. This violates N.J.S.A. § 19:48-1 which requires that all voting machines used in New Jersey be "thoroughly tested and reliable."

Although the newly reconstituted Title 19 Certification Committee conducted a hearing on April 28, 2010, that certification was seriously flawed and should not have been approved by the trial court. The record clearly demonstrates that the Title 19 Committee's April 28, 2010 hearing did not meet the criteria required under N.J.S.A. § 19:48-1. Despite this however, the lower court incorrectly ruled that the certification process was proper. (9/23 Hr'g Tr. at 77:9-10.)

Appellants ask this Court to overturn the Certification Committee's findings. This Court should also order that the insecure and unreliable Sequoia Advantage 9.00H be replaced with an auditable voting system. It should also order the State of New Jersey to adopt more rigorous standards for evaluating the State's voting machines; standards that actually examine software and source code for bugs and other insecurities. Such

standards exist and were presented to the trial court by the Appellants.

A. The April 28, 2010 Certification Hearing Was Ceremonial And Not Substantive.

The Title 19 Committee's April 28, 2010 hearing on the AVC Advantage was purely ceremonial. As discussed below, the presentation consisted almost entirely of a question and answer session with Sequoia employees, rather than an actual examination.

The Title 19 Committee hearing took only two hours and 45 minutes, and consisted of a product presentation by employees of Sequoia Voting Systems. Only a few minutes of the hearing consisted of actual examination, the casting of only six votes. (Transcript of 4/28/10 Title 19 Hr'g at 109:14-15; Pa1463.) This completely disregards the requirement of N.J.S.A. § 19:48-1 that voting machines used in New Jersey be "thoroughly tested[.]"

Prof. Appel, who evaluated the voting machine certification process in a certification dated August 26, 2010, stated: "[t]he computer scientists on the committee did not examine a single line of source code or machine code, did not examine a single document describing the internal architecture of the AVC Advantage, and made only the most superficial physical inspection of the machine." (8/27/10 Appel Cert. at ¶ 2;

Pa1615.) This is, as Prof. Appel states, "wholly inadequate to even begin to determine whether or not the AVC Advantage is accurate and reliable, and whether it preserves the secrecy of the ballot." (Id.)

B. The Title 19 Committee Examined The Wrong DRE In April 2010.

The AVC Advantage 9.00H is the most widely used voting machine in New Jersey and has been the subject of this litigation. However, the Title 19 certification transcript shows that the Title 19 Committee did not examine the correct voting machine. Instead, the Committee examined an older version, the AVC Advantage 9.00G. (Tr. of 4/28/10 Title 19 Hr'g at 35:20-21; Pa1399.) The 9.00G is used in only two counties in New Jersey. (Id. at 35:15 to 36:11; Pa1399-1400.) Failing to examine the correct version of the DRE shows a lack of seriousness and a total disregard for the vital role that the certification process plays in protecting the franchise.

C. The Title 19 Committee Was Completely Unfamiliar With The Most Basic Details Of The Sequoia AVC Advantage.

The April 28 presentation of the Sequoia AVC Advantage 9.00G DRE consisted entirely of Sequoia employees assuring the Committee that the AVC Advantage was reliable. Even the few questions of the Committee members to the Sequoia employees reveal a total lack of knowledge of the DRE being examined. As

Prof. Appel concluded, “the computer scientists on the committee lacked even the most basic information about the hardware architecture of the AVC Advantage.” (Tr. of 4/28/10 Title 19 Hr’g at 27:3-10; Pa1392; 8/27/10 Appel Cert. at ¶¶ 12, 14; Pa1618-20.)

For example, one Committee member, Mr. Sawaged, asks of Sequoia’s Mr. Terwilliger: “Is this hard drive based?” (Tr. of 4/28/10 Title 19 Hr’g at 27:17-18; Pa1392.) How the AVC Advantage stores memory is an utterly basic aspect of the DRE. The memory of the AVC Advantage is at the very core of this litigation. Committee members should have known the answers to these questions. This is especially true of the Chairman of the Title 19 Committee, who was personally involved in this litigation, and acknowledged that the certification hearing was taking place because of court order. (Id. at 13:14-24; Pa1380-81.)

Further showing the Committee’s lack of knowledge of the basic workings of the Sequoia AVC Advantage, Mr. Sawaged, during the hearing, asked: “What prevents anybody from taking those chips out and put in their own chips?” (Id. at 77:16; Pa1435.) While this is an excellent question, the fact that Mr. Sawaged did not know the answer before the hearing shows that he had not been provided with information sufficient to conduct an adequate examination of the Sequoia AVC Advantage.

Tellingly, the Sequoia employees did not answer Mr. Sawaged's question honestly. They merely assured the Committee that "[t]he physical security, the seals[]" would prevent tampering. (Id. at 77:19-20; Pa1435.) This answer was disingenuous and ignored extensive trial testimony about the inadequacy of New Jersey's seals.

As Dr. Roger Johnston's report and trial testimony demonstrated, the seals that were contemplated by New Jersey for use on its DREs are wholly inadequate. (Johnston Test., 4/22 Trial Tr. at 120:24-25.) Further, as Prof. Edward Felten's testimony demonstrated at trial, there is virtually no physical security for the State's DREs. They are left unattended at polling places for weeks before and after each election. (Felten Test., 2/10 Trial Tr. at 17:18 to 18:12, 18:16 to 19:1, 21:10-18, 22:2-7, 23:8 to 24:19, 24:21-23.) There is no seal use protocol in place to protect the legitimate ROM chips from being replaced. (Giles Test., 3/3 Trial Tr. at 133:12 to 135:16, 174:6-19, 169:16-25.)

As Prof. Appel stated, the information provided to the Title 19 Committee was largely irrelevant. The Title 19 Committee lacked even the most basic information about the Sequoia AVC Advantage. Prof. Appel concluded that, "[b]ecause of the superficiality [of the examination], I do not believe the committee had a basis to make any recommendation to the

Secretary of State regarding this machine." (8/26/10 Appel Cert. at ¶ 4; Pa1616.)

D. The Title 19 Committee Disregarded Known Problems of Critical Importance with the AVC Advantage's Storage of Vote Data.

One of the central factual issues at the core of this lawsuit is the manner in which the Sequoia AVC Advantage stores its electronic voting records. The AVC Advantage stores four separate copies of these records. It stores the vote totals on the results cartridge and in the DRE's internal memory; and it stores "ballot images," a record of each individual vote, on the results cartridge and in the DRE's internal memory. (Appel Test., 2/9 Trial Tr. at 21:19 to 22:3.)

However, as Prof. Appel's hack demonstrated, if the original vote is manipulated through a hack, all subsequent copies of the vote will also reflect the hack, and be identical to the altered vote. (Appel Test., 1/28 Trial Tr. at 111:14 to 113:10, 121:15-122:5, 121:2-6; DVD 1, 18:47; Ex. P-3; Pa728.) Fraudulent firmware will alter all four vote total records. Rather than providing any real security, the redundant records merely create a false sense of security.

This memory issue is central to this litigation and should have been considered by the Committee. The Committee should have known about this serious software flaw. Chairman Woodbridge was on the Title 19 Committee when it certified an

earlier version of the AVC Advantage in 1987. Chairman Woodbridge also testified on behalf of Appellees in this litigation. However, the Title 19 Committee did not examine the AVC Advantage for known memory issues. Sadly, Chairman Woodbridge showed no signs of being aware of these issues, asking: "When the voter finishes voting, how is the vote stored? How many memories are there? How is it stored? And how do you know those memories are all synched up?" (Tr. of 4/28/10 Title 19 Hr'g at 31:3-8; Pa1395-96.)

The Committee then simply accepted Mr. Terwilliger's description of how the AVC Advantage handles its memory, ignoring the serious known flaws described by Prof. Appel in his expert report and at the trial.

As was demonstrated at trial, there is no inherent internal connection between the buttons on the front panel and the totals kept in memory. (Appel Report, § 2.3 at 11; Ex. P-2; Pa543.) Therefore, erroneous or fraudulent firmware can easily add to the wrong total or make some other error at any time during an election, thereby misrecording votes. (Tr. of 4/28/10 Title 19 Hr'g at 31:3 to 33:12; Appel Report, § 2.3, 11; Ex. P-2; Pa543.) While Mr. Terwilliger describes the redundant memory as an "audit trail," it is not an audit trial. In fact, as discussed more thoroughly in Section AI4 of the "Statement of Facts" of this Brief, every copy can be modified by the firmware. (Appel

Report, § 2.4, 11; Ex. P-2; Pa543.) Therefore, as discussed in Section II of this brief, this is not an effective audit mechanism.

Another central issue discussed at the trial is that even the legitimate firmware, when not replaced with fraudulent firmware, contains serious flaws. Prof. Appel detailed these flaws in his expert report. (Appel Report § 5, 106-14; Ex. P-2; Pa637-45.) Despite this, Prof. Appel notes, "the computer scientists on the Title 19 Committee did not examine a single line of source code or machine code[.]" (8/26/2010 Appel Cert; Pa1615.)

E. The Committee Improperly Relied Upon Legal Conclusions Provided By Sequoia Employees When Validating The Certification Process of the Title 19 Materials.

During the hearing, Chairman Woodbridge recited the voting machine requirements of N.J.S.A. § 19:48-1 and § 19:53A-3, and then asked a Sequoia employee whether the Sequoia AVC Advantage satisfies these requirements. (Tr. of 4/28/10 Title 19 Hr'g at 80:3 to 100:15; Pa1437-55.) This, on its face, violates Title 19. The statute requires that voting machines be "thoroughly tested[.]" N.J.S.A. § 19:48-2. Clearly, this requirement is not satisfied by asking the vendor for its legal conclusions as to whether their wares meet State law requirements. Obviously, any vendor will answer "yes" to such a question.

The Committee abdicated its obligations to determine whether the AVC Advantage meets New Jersey's statutory requirements. It blindly accepted the improper legal conclusions of Sequoia employees, rather than conducting its own investigation. (See generally 4/28/10 Title 19 Hr'g, Terwilliger Test and McIntyre Test; Pa1377-463.) (Sequoia employees' testimony make up bulk of the transcript.) In short, the Committee simply lacked any factual basis for its findings. (8/26/10 Appel Cert. at ¶ 4; Pa1616.)

F. The Standards Used To Test The Sequoia AVC Advantage Are Obsolete.

As Sequoia employee Mr. Coomer admitted at the April 28 Title 19 hearing, the AVC Advantage was tested only to the 1990 standards. (Tr. of 4/28/10 Title 19 Hr'g at 79:16-25; Pa1437.) Mr. Terwilliger was present at both the trial in this case and the April 28, 2010 Title 19 hearing. At trial, Mr. Terwilliger testified that the 1990 standards did not involve examining software. (Terwilliger Test., 3/30 Trial Tr. at 21:8-17.)

Nevertheless, taking the trial court's lead, the Title 19 Committee failed to impose a more rigorous standard of evaluation of the Sequoia AVC Advantage DRE it was examining. (Tr. of 4/28/10 Title 19 Hr'g at 79:14-25; Pa1437.) Failure of the Committee to require all voting machines to, at a minimum, meet the most recent and most stringent standards shows that the

Certification Committee did not "thoroughly test[]" the Sequoia AVC Advantage.

As discussed in Appellees' multiple submissions to the lower court, and by both Appellees' and Defendants' expert witnesses at trial, the 1990 Voluntary Voting System Guidelines are obsolete. (Smith Test., 3/18 Trial Tr. at 92:21 to 93:3; Terwilliger Test., 3/30 Trial Tr. at 21:8-17; Woodbridge Test. 3/4 Trial Tr. at 43:12-13.) As even Defendants' expert concurred, the 1990 standards are completely useless for electronic voting machines. (Shamos Test., 3/23 Trial Tr. at 192:9 to 193:4.) Indeed, Dr. Shamos even testified before Congress in 2004, demanding that a new federal voting machine testing system be created from scratch.[41]

The 1990 standards fail to examine the software, the most critical aspects of a computer-based DRE. Despite the Title 19 Committee's failure to examine the DREs' software, the lower court still validated the certification.

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[41] Testimony of Michael Shamos before the Environment, Technology, and Standards Subcommittee of the U.S. House of Representatives' Committee on Science, June 24, 2004, available at, http://euro.ecom.cmu.edu/people/faculty/mshamos/HouseScience.htm (Stating "I am here today to offer my opinion that the system we have for testing and certifying voting equipment in this country is not only broken, but is virtually nonexistent. It must be re-created from scratch or we will never restore public confidence in elections.")

In sum, the Title 19 Committee failed to "thoroughly test[]" the Sequoia AVC Advantage 9.00H as required by N.J.S.A. § 19:48-2. Instead of conducting a thorough examination using the information and science gathered in this litigation, the certification process was a ceremony devoid of substance. The Committee examined the little-used Sequoia AVC Advantage 9.00G, instead of the 9.00H. Further, the Committee failed to examine the source code or any of the DRE's software.

It is legally unacceptable that the post-trial voting machine certification process suffers from exactly the same defects as the previous certification, which the court found to be legally deficient. Indeed, at trial, Appellees' own expert, Dr. Shamos, who performs voting machine examinations in the Commonwealth of Pennsylvania, described New Jersey's certification process as "inadequate." (Shamos Test., 3/23 Trial Tr. at 188:4-17.)

As such, the State's certification of the Sequoia AVC Advantage 9.00G and 9.00H violated Title 19. The April 28, 2010 hearing was not a "full certification examination." It did not thoroughly test the voting machine for accuracy and reliability as required by Title 19. N.J.S.A. 19:48-1. Therefore, the lower court incorrectly validated the certification of the Sequoia AVC Advantage and should be reversed.

Appellants ask this Court to overturn the Certification Committee's findings. The Court should also order that the insecure and unreliable Sequoia Advantage 9.00H be replaced with an auditable voting system. It should also order that the State of New Jersey adopt more rigorous standards for evaluating voting machines; standards that actually examine software and source code for bugs and other insecurities. Such standards exist and were presented to the trial court by the Appellants.

V. THIS COURT SHOULD TAKE JUDICIAL NOTICE OF EVENTS THAT OCCURRED AFTER THE TRIAL COURT ISSUED HER MARCH 8, 2010 ORDER BECAUSE THEY DEMONSTRATE THAT THE COURT MADE SERIOUS LEGAL AND FACTUAL ERRORS, AND THAT APPELLANTS HAVE FAILED TO COMPLY WITH THE TRIAL COURT'S SPECIFIC ORDERS.

Although the trial court issued an order on March 8, 2010, she retained jurisdiction over the case until June 6, 2011. During and after that time, events occurred that showed the trial court's legal and factual conclusions were wrong.

This Court should take judicial notice of events that occurred after the trial court signed her first post-trial order in this case, on March 8, 2010, until she signed her trial order in the case on June 6, 2011. This Court should also take judicial notice of events related to a June 7, 2011 Cumberland County election where a court overturned the election because the DRE in use misattributed votes.

All of the events that occurred after the trial court signed her March 8, 2010 order, taken together, show that it is

easy to make the Sequoia Advantage DRE misattribute votes, and that there are no safeguards to catch those errors. The post-trial events discussed herein also show that any security measures ordered by the trial court have not been implemented. As a result, the State's 11,000 Sequoia Advantage 9.00H DREs remain insecure and vulnerable to tampering.

Under N.J.R.E. 201, "Judicial notice of law and adjudicative facts," section (d), a court shall take "judicial notice if requested by a party on notice to all other parties and if supplied with the necessary information." Under N.J.R.E 201(a), law which may be judicially noticed includes the decisional law of New Jersey and determinations of all governmental subdivisions and agencies thereof.

Under N.J.R.E. 201(b), facts which may be judicially noticed include:

> (2) such facts as are so generally known or are of such common notoriety within the area pertinent to the event that they cannot reasonably be the subject of dispute, (3) specific facts and propositions of generalized knowledge which are capable of immediate determination by resort to sources whose accuracy cannot reasonably be questioned, and (4) records of the court in which the action is pending and of any other court of this state or federal court sitting for this state.

N.J.R.E. 201(b). Courts have applied this rule to allow judicial notice of information in articles and reports. For

example, in Planned Parenthood v. Farmer, the New Jersey Supreme Court took judicial notice of a published article by the American Medical Association's (AMA) Council on Ethical and Judicial Affairs entitled "Mandatory Parental Consent to Abortion," to note the AMA's support for confidential medical care for adolescents and the negative consequences of disclosure to the parents of such patients. Planned Parenthood v. Farmer, 165 N.J. 609, 640 (2000). In that case, the Court struck down the New Jersey Parental Notification for Abortion Act as unconstitutional. Id. at. 612.

Courts have discretion to take judicial notice. In University Plaza Realty Corp. v. City of Hackensack, the Appellate Division approved judicial notice of health hazards related to asbestos by tax courts assessing property values. University Plaza Realty Corp. v. City of Hackensack, 264 N.J. Super. 353, 358 (App. Div. 1993). Although Hackensack argued that the Court should have accepted its expert's conclusion that asbestos contamination did not impact property values, id. at 357, the Appellate Division approved the use of judicial notice of health hazards posed by asbestos.

In another case, the District of New Jersey took judicial notice of litigation in State courts. It held that the general history preceding a law creating the New Jersey Sports and Exposition Authority "is well-known throughout the State and may

be judicially noticed. Much of the history is reviewed in the litigation challenging the validity of the Act under the N.J. Constitution." Int'l Soc. for Krishna Consciousness, Inc. v. New Jersey Sports & Exposition Auth., 532 F. Supp. 1088, 1092 (D.N.J. 1981) aff'd, 691 F.2d 155 (3d Cir. 1982)(citing N.J. Sports and Exposition Authority v. McCrane, 119 N.J. Super. 457 (1971), aff'd as modified and remainded 61 N.J. 1 (1972), appeal dismissed 409 U.S. 943 (1972)).[42]

As such, this Court has the authority to take judicial notice of events that took place between the trial court's March 8, 2010 and June 6, 2011 orders, as well as events related to a DRE misappropriating votes in Cumberland County.

A. This Court Should Take Judicial Notice Of Events In Gusciora v. Christie From March 8, 2010 To June 6, 2011 Because Those Events Demonstrate The State's Failure To Comply With The Trial Court's March 8, 2010 Order To Secure The DREs.

This Court should consider events in the Gusciora case that took place between the March 8, 2010 order and the final order of June 6, 2011 because they address the State's failure to comply with the many security measures the trial court ordered on March 8, 2010. The trial court's complacence with the

[42] Fed. R. Evid. 201(b), and N.J.R.E. 201 (b) both state that facts which may be judicially noticed include facts which are generally known within the area pertinent to the event or territorial jurisdiction.

State's noncompliance perpetuates the already unacceptable level of insecurity of the State's DREs.

Under N.J.R.E. 201(b)(4), records of any court of the State shall be judicially noticed. As a result, Judge Feinberg's orders, transcripts as well as correspondence between the parties and the Court from the period between the March 8, 2010 order and the June 6, 2011 final order, should be judicially noticed.

In addition, under N.J.R.E. 201(a), law which may be judicially noticed includes decisional law and government agency determinations. This Court should thus consider determinations of the Office of the Attorney General and State Division of Elections that are related to failure to comply with the March 8, 2010 order from this period of the Gusciora litigation. Under Int'l Soc. for Krishna Consciousness, Inc. v. New Jersey Sports & Exposition Auth., courts may take judicial notice of history that is detailed in litigation in other courts. Int'l Soc. for Krishna Consciousness, 532 F. Supp. at 1092.

Just as the Appellate Division approved the consideration of health hazards related to asbestos exposure and their impact on property values in University Plaza Realty Corp. v. City of Hackensack, this Court should take judicial notice of facts that are not in the trial record but are raised by Appellants pertaining to the State's failure to comply with the Court's

March 8, 2010 order, as documented in the Gusciora litigation from 2010 to 2011. University Plaza Realty Corp., 264 N.J. Super. at 358.

1. The Trial Court Should Have Granted A Final Order Stating That The State Was Not In Compliance With The Trial Court's Orders, Rather Than Allow The State To Continuously Miss Deadlines.

In her February 1, 2010 opinion and March 8, 2010 order, the trial court made clear that the State's voting machines are not secure. On March 8, 2010, the trial court ordered the Appellees to take certain measures to secure the State's DREs and gave the Appellees until July 7, 2010 to comply with the order. The Appellees failed to meet the trial court's deadlines.

Starting in summer 2011, Appellants brought the Appellees' missed deadlines to the trial court's attention. With each missed deadline, Appellants requested that the trial court enter a final order finding that the Appellees were not in compliance with the trial court's orders.

The trial court instead allowed the Appellees to consistently disregard her deadlines. This delayed the implementation of security improvements to the State's voting machines indefinitely. The Appellees have still not satisfied the directives in the trial court's March 8, 2010 order.

The trial court's generosity in granting the Appellees multiple extensions delayed by a year Appellants' ability to appeal the trial court's opinion. The trial court should have issued a final order noting the State's noncompliance with her March 8, 2010 order, rather than allow the Appellees to continuously delay implementation of orders that would make the State's voting machines more secure.

a. The Trial Court Erred By Allowing The Appellees To Fail To Comply With Its Internet Connectivity Orders.

In its March 8, 2010 order, the trial court ordered the Appellees to assist counties in ensuring the integrity of the transmission of election data between municipal clerks and county clerks by July 7, 2010. Acting unilaterally, and without seeking court approval, the Appellees failed to meet that deadline and said that the State would not comply with the court's order until at least September 2011, fourteen months past the deadline. To date, there is no evidence that the State has even complied with this deadline.

Despite the July 7, 2010 deadline, the State, over three months later, on October 28, 2010 revealed that it had unilaterally decided to undertake an additional, 30-week firmware software upgrade project to the Sequoia Advantage 9.00K. (10/28/10 State's Ltr. at p. 9-10; Pa467-68.) Under this new plan, the State would not implement any security

measures until new software is installed in the State's 11,000 DREs. (10/28/10 Robert Giles Cert. ¶ 11; Pa479.) Accordingly, the State's security enhancements could only be delivered and installed, at the earliest, in September 2011. (Id. at 9; Pa482.)

But, as Appellants pointed out to the trial court, that deadline is wishful thinking. The Appellees even admitted that before new software can be installed on the State's DREs, the 9.00K firmware must be tested federally and examined by the State Voting Machine Examination Committee, and Sequoia must submit a report for the proposed firmware installation. (Id.) There was no guarantee that the 9.0K software would be developed on time, or pass testing or State certification. As a result, the deadline for implementing the trial court's security measures, as ordered on March 8, 2010, is essentially open-ended.

Although Appellants, in their November 9, 2010 letter to the trial court, objected to the State's self-awarded deadline (Pa508), the trial court allowed it. As a result, to this day, there is no way to know whether the new software was certified or installed, and whether other security measures ordered on March 8, 2010 were implemented. This leaves the Sequoia Advantage DREs as insecure as they were when this litigation started, for an indefinite period of time.

b. The Trial Court Erred By Allowing The State To Fail To Comply With Its Hardening And Anti-Virus Orders.

The trial court on March 8, 2010 ordered that each county clerk must examine the means by which election data is transmitted to his or her office and that the State must assist county clerks in developing plans to ensure the integrity of the transmission of election data. (Gusciora Court Order of March 8, 2010; at 3-4; Pa137-138.) Those counties that do not provide a plan must hand-deliver voting machine results cartridges. (Id.)

However, the Appellees did not comply with the trial court's order in the areas of anti-virus software, hardening and Internet connectivity, and the certifications that it provided were not valid.[43] As Appellants stated in their October 15, 2010 brief and November 9, 2010 letter (Pa508) to the trial court, as well as at a December 1, 2010 hearing, the State did not submit

[43] The trial court found that hardening techniques are available at little or no cost to the State, and ordered that hardening be completed by July 7, 2010. Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. February 1, 2010) (slip op. at 202; Pa343.) However, Zirkle v. Henry in Cumberland County raised serious questions about whether hardening was implemented state-wide. Although Cumberland County certified it had complied with Judge Feinberg's Order on June 10, 2011, Prof. Appel stated after reviewing Cumberland County's WinEDS computer on August 17, 2011 that "due to the state of the System and Security event logs, it was most likely that the 'hardening guidelines' . . . were applied to this computer on the afternoon of August 16, 2011, the day before my examination." (8/18/11 Appel Cert. ¶¶ 22a, 23; Pa1632-1633.)

valid certifications demonstrating compliance with the trial court's order that they install hardening and anti-virus software and not connect computers used for election result transmission to the Internet. Instead, the State submitted undated Internet connectivity certifications signed by county election officials, vendors or county clerks. This violates New Jersey Court Rule 1:4-4, which reads, "[An] affiant may submit the following certification which shall be dated . . . ." R. 1:4-4.

The certifications provided by the Appellees are facially defective and should not have been considered by the trial court. Facially invalid certifications offer no proof of compliance with the trial court's orders concerning hardening and anti-virus measures. However, the trial court excused the noncompliance, stating, "All right. Well, they're going to have to be dated in the future." (12/1/10 Hr'g. Tr. 12: 13-14.) The trial court allowed the Appellees to provide late, facially deficient certifications, in violation of her orders and the New Jersey Court Rules.

The Appellees also failed to comply with the trial court's orders for the submission of certifications from Monmouth and Sussex counties, and misled the trial court by failing to mention this non-compliance.

On October 4, 2010, the State submitted Sussex County's certification of compliance, with an addendum stating that Sussex County will not be in compliance with the hardening and anti-virus directives until "prior to . . . the General Elections on November 2, 2010." By November 9, when Appellants raised this issue to the trial court, the State still had not shown that Sussex County was in compliance with the trial court's order. At the December 1, 2010 hearing, Appellants' counsel again stated that the State had not submitted certifications of compliance with the hardening and anti-virus directives for Sussex County. (12/1/10 Hr'g. Tr. 15:9-14.) In response, the trial court simply asked the Appellees for the certifications, giving them more time to submit certifications that were already months overdue. Id. at 15:24- 16:4.

The trial court similarly allowed noncompliance regarding Monmouth County's certification. Although the State, on October 4, 2010, submitted Monmouth County's initial certification that it would not remotely transmit election results, on October 28, 2010 it submitted a new certification indicating that it would instead remotely transmit the data. (10/28/10 State's Ltr; Pa499.) In response, Appellants in a November 9, 2010 letter to the trial court (Pa508) stated that the State should not be permitted to alter its security improvement plans four months after the deadline for compliance with the March 8, 2010 order.

Rather than issuing a final order finding noncompliance, the trial court accepted the State's late change in Monmouth County's transmission mode.

Months after Appellees should have been in compliance with the trial court's hardening, anti-virus and internet connectivity orders, the trial court allowed the Appellees to delay security improvements. Despite Appellants' attempts to draw attention to the State's noncompliance, the trial court issued no sanctions or findings of noncompliance.

2. The State Failed To Comply With The Trial Court's Order To Produce A True Seal Use Protocol With Training Materials.

At trial, Appellants' expert witness Roger Johnston of Argonne National Laboratories testified extensively about the lack of physical security of the State's DREs. Dr. Johnston is one of the world's foremost experts in physical security and is employed by the federal government to evaluate issues related to national security. Dr. Johnston testified that any physical security measures contemplated by the State of New Jersey for its voting machines were inadequate. Both Dr. Johnston and Prof. Appel readily defeated all of the voting machine security measures contemplated by the State.

On March 8, 2010, the Court recommended the State by July 7, 2010:

> develop and implement Statewide training and training materials for county clerks, boards of election, superintendents of elections, technicians, warehouse personnel and district board workers. Part of that training must include protocols for the chain of custody and maintenance of election records and documentation, including, but not limited to, authorization slips, poll books, results cartridges, seals and serial numbers, emergency ballots, provisional ballots, mail-in ballots, military and overseas ballots, ballot bags, voting machine tapes and printouts.

(Gusciora v. Christie, No. MER-L-2691-04) (Law Div. March 8, 2010)(Order at 4-5; Pa138-139.)

a. The State Missed Important Deadlines and Produced a Faulty Protocol

However, the State failed to comply with that deadline. On July 29, 2010, Robert Giles, Director of the State Division of Elections, filed a certification with the trial court stating that training would take place between November 2010 and February 2011, and that the State had not yet developed training materials. (7/29/10 Giles Cert. §§ 10, 12; Pa395-396.) In its September 14, 2010 letter to the trial court, the State admitted that it had missed another deadline, and that training would take place from January to April 2011. At a September 23, 2010 hearing on the State's failure to comply with deadlines in the March 8, 2010 order, the State could not answer questions about whether seal use protocol training materials were completed.

(9/23/10 Hr'g Tr. 29:2.) This suggests that they were incomplete.

In response to the State's failure to meet the trial court's deadlines for items including the seal use protocol materials, Appellants in August 2010 requested that the trial court sign an order finding that the State was not in compliance with the March 8, 2010 order. (Reply Memorandum of Law in Support of Plaintiffs' Motion Asking The Court To Find That Defendants Are Not In Compliance With the Court's March 8, 2010 Order, 4, 6, Aug. 30, 2010.) Rather than put the State's feet to the fire, the trial court instead approved the January 2011 start of the training program. (9/23/10 Hr'g Tr. 30:21-23.)

On October 15, 2010, Appellants requested that the trial court sign a final order and judgment, finding that the State had failed to comply with the trial court's orders to secure the State's DREs. (Memorandum Of Law Discussing Plaintiffs' Responses To The State's October 5, 2010 Submissions To The Court.) The Appellants' brief included a certification from Dr. Johnston, the only expert in physical security recognized by the trial court in this litigation. (10/14/10 Johnston Cert.; Pa445-58.)

Dr. Johnston certified that the State had not produced a valid seal use protocol and that the trainer selected by the

State was not qualified. (10/14/10 Johnston Cert. at 3-13; Pa447-57.) As Appellants wrote on October 15, 2010:

> - Although the State's proposed seal use protocol was revised three times between the trial court's July 7, 2010 deadline and September 2010, it remained fatally deficient, according to Dr. Johnston.
>
> - The State had not set a schedule for implementing its seal use protocol.
>
> - The State's trainer, William McLeod, lacks the requisite knowledge or expertise to devise a seal use protocol or train others to secure the State's DREs.

Despite the issues raised in Appellants' October 15, 2010 submission, the trial court failed to find that the State was out of compliance with the trial court's order. The trial court issued no sanctions, and denied Appellants' motion for an evidentiary hearing. Instead, at the December 1, 2010 hearing, the trial court approved the State's incomplete and flawed proposed seal use protocol, stating: "I know Dr. Johnston has some problems with it, but this is post-trial and I'm satisfied. And there's absolutely no reason to hold a hearing [on the adequacy of the seal use protocol or the qualifications of Mr. McLeod]," the trial court stated. (12/1/10 Hr'g Tr. at 49:23-50:1.)

Although Appellants stated that they had not had the opportunity to cross-examine Mr. McLeod (Id. at 35:21-22), and requested testimony regarding the seal use protocol, the trial

court stated that such testimony was not necessary. (Id. at 47:12-14.) At the same hearing, the trial court approved the State's plan to start seal use training in January 2011, several months after the deadline. (Id. at 40:9.) This was improper. Since the trial court retained jurisdiction over the case, the Appellants should have been permitted to present evidence about the inadequacy of the State's expert. Such evidence would have permitted the trial court to make an informed decision about whether the State was in compliance with the security measures articulated in her March 8, 2010, order.

b. The Trial Court Erred By Refusing To Allow Appellants To See The State's Training Materials.

The trial court erred by allowing the State to withhold all materials related to its seal use protocol training for officials. Appellants are entitled to view these materials and should have been allowed to do so.

At the September 23, 2010, hearing, the trial court stated that Appellants are entitled to review materials related to the State's seal use protocol, which includes training materials. (9/23/10 Hr'g Tr. at 29:20-25; 30:1-2.) After the State could not answer questions regarding the qualifications of its designated trainer, William McLeod, (9/23/10 Hr'g Tr. at 31:23-25 to 32:6), the Court directed the State to provide his CV (Id.

at 30:18-21) and provide Plaintiffs "as many materials as they can get." (Id. at 33:18-20.)

Specifically, the trial court ordered the State to submit to the trial court its seal use protocol training materials and to "identify sections that you believe can be shared with counsel. And, I want you to be generous with that . . . they [Appellants] are entitled to see that, to the extent that it doesn't compromise security." (Id.) The trial court gave the State ten days to produce the training materials. (Id. at 84: 23-24.)

The State ignored the trial court's deadline for the production of training materials and withheld all training materials from the Appellants. The State simply made a blanket declaration in its October 4, 2010 letter that: "we have conferred with Mr. McLeod about his training materials and he has advised that they are classified as law enforcement sensitive and, therefore, these materials will only be provided to the Court for in-camera inspection." The trial court should have enforced its September 23, 2010 orders, but it instead, over Appellants' objections, simply accepted the Appellees' recommendation that training materials not be released.

The trial court should not have blindly accepted the recommendation of the State's trainer, who never appeared before the trial court, and whose qualifications were challenged by Dr.

Johnston, the only expert that the trial court has recognized in the area of physical security. (Id. at 32:24-25.)

Appellants should have been given access to the training materials and should have been permitted to present evidence about them. Only through this adversarial process would the trial court have been able to determine whether those materials complied with her March 8, 2010, order.

(i) The "Law Enforcement Sensitive" Designation Is Meaningless From A Security Perspective.

The State failed to give Appellants the training materials ostensibly because its training materials were deemed "Law Enforcement Sensitive." Labeling the training materials "Law Enforcement Sensitive" is meaningless from a security perspective. The "Law Enforcement Sensitive" designation is applied solely to unclassified material. (See DEPARTMENT OF HOMELAND SECURITY, MD NUMBER 11042.1, SAFEGUARDING SENSITIVE BUT UNCLASSIFIED INFORMATION, PAGE 4, §2 (2005).

Under Executive Order 13526, entitled "Classified National Security Information," the designation of "Confidential" information is the lowest level of classification. Exec. Order No. 13,526 § 1.2, 3 C.F.R. 298 (2009). "Confidential" applies to "information, the unauthorized disclosure of which reasonably could be expected to cause damage to the national security that the original classification authority is able to identify or

describe." Id. Other security clearances recognized by the United States are, in ascending order, "secret" and "top secret." Id. "Law Enforcement Sensitive" is not even on the list. Because "Law Enforcement Sensitive" can legally refer only to unclassified materials, as a matter of law, Appellants are entitled to view the training materials, and the trial court should have allowed them to do so.

Further supporting the Appellants' entitlement to the training materials is that the State of New Jersey's Open Public Records Act does not exempt "Law Enforcement Sensitive" materials. See N.J.S.A. 47:1A-1 et seq. "Law Enforcement Sensitive" materials also are not exempt from Freedom of Information Act (FOIA) requests. See 5 U.S.C.A. § 552(b)(1)-(9). The designation thus does not prohibit the public from viewing materials marked "Law Enforcement Sensitive" through public records requests. As such, Appellants are not prohibited from viewing the training materials, and the trial court should not have withheld the materials.

Materials designated "Law Enforcement Sensitive" are also commonly available for public viewing on the Internet. For example, the New York Police Department Intelligence Division's 2008 Law Enforcement Sensitive "Mumbai Attack Analysis" also is available for public viewing online. See N.Y.P.D. Intelligence Division, Mumbai Attack Analysis, Dec. 4, 2008,"

http://publicintelligence.net/nypd-law-enforcement-sensitive-mumbai-attack-analysis/; Pa1243; see also National Gang Intelligence Center, Gangs Infiltrating Law Enforcement and Correctional Agencies Intelligence Report, Jan. 15, 2010, http://info.publicintelligence.net/NGIC-GangInfiltration.pdf; Pa1292; (Publicly posting the National Gang Intelligence Center's Law Enforcement Sensitive Intelligence Report regarding gang infiltration of law enforcement and correctional agencies); U.S. Department of Justice, Bureau of Alcohol, Tobacco and Firearms. Project Gunrunner: A Cartel Focused Strategy, Sept. 2010, http://info.publicintelligence.net/ATFgunrunnerstrategy.pdf (publicly posting the United States Department of Justice Bureau of Alcohol, Tobacco and Firearms' Law Enforcement Sensitive strategy for fighting Mexican violence related to drugs and firearms; Pa1300.)

Because the "Law Enforcement Sensitive" designation is for unclassified materials that are available to the public, Appellants are entitled to review the training materials as a matter of law. The trial court erred by maintaining the secrecy of the materials and deprived the Appellants of the right to challenge the validity of those materials.

(ii) Mr. Mcleod Does Not Have The Authority To Classify State Materials.

The trial court also erred by recognizing Mr. McLeod's authority to classify materials that are not officially related to his federal duties. At the September 23, 2010, hearing, Ms. Kelly stated that McLeod developed materials specifically for use in his training of New Jersey election officials. (9/23/10 Hr'g Tr. at 29:2-6.)

Dr. Johnston, who has a "top secret/SCI" security clearance, finds Mr. McLeod's "labeling of the training documents as 'Law Enforcement Sensitive' very problematic." (10/14/10 Johnston Certif. ¶38; Pa458). As Johnston stated, "if the training materials were related to [McLeod's] DHS work, they would not be applicable to securing voting machines," and McLeod would not have the authority to share federal materials with the State of New Jersey. (Id.) Conversely, according to Dr. Johnston, if McLeod "developed the materials as a private citizen who is consulting with the State of New Jersey, he would not be acting in his official federal capacity," and, outside his official employment, would lack authority to designate the materials as "Law Enforcement Sensitive." (Id.) As such, Appellants are entitled to the training materials, and the trial

court erred by refusing to provide access to the training materials.

In New Jersey, there is a presumption of public access to documents and materials and "no record of any portion thereof shall be sealed by order of the court except for good cause shown." R. 1:2-1. The good cause standard is outlined in Hammock v. Hoffman-LaRoche, Inc., 142 N.J. 356, 375 (1995). "There is a presumption of public access to documents and materials filed with a court in connection with civil litigation. That right exists under the common law as to the litigants and the public." Id.

There is no New Jersey or federal statutory or case law that justifies the State's keeping the training materials from the Appellants. "In a democracy, the citizens generally have the right to know the truth about all parts of their government, because, without public knowledge of the realities of governmental activities, essential reforms of those activities will be hindered." McClain v. College Hospital, 99 N.J. 346, 355 (1985).

Although in camera review of documents is permissible, it is allowed under very limited circumstances. Relevant evidence that is not protected by a privilege is always given to litigants. In the context of discovery, where "a claim of privilege is disputed, an in camera review by the court of the

allegedly privileged material is ordinarily the first step in determining the issue." Pressler, Current N.J. Court Rules, comment 6 on R. 4:10-2 (citing Loigman v. Kimmelman, 102 N.J. 98 (1986) and other cases). Here, the State has made no specific claim of privilege. Instead, the State attempted to fashion an ad hoc review process not contemplated by our rules.

Additionally, Appellees did not assert a privilege recognized by the New Jersey Rules of Evidence. "All relevant evidence is admissible at trial unless prohibited by a specific rule." State v. Koskovich, 168 N.J. 448, 480 (2001)(holding that trial court properly admitted relevant evidence). Beyond the point of discovery and trial, the trial court allowed the State to withhold from Appellants an admittedly relevant document without a specific claim of privilege.

As such, the trial court permitted use of secret evidence. The only tribunals that have previously attempted the use of secret evidence have been the United States military courts and commissions established after the 9/11 attacks. The U.S. Supreme Court subsequently found those practices to be legally unsupportable.

In Hamdan v. Rumsfeld, the defendant, who was detained by the U.S. military after being captured in Afghanistan, was denied access to hear and review evidence against him. Hamdan v. Rumsfeld, 548 U.S. 557, 635 (2006). He was charged with

conspiracy to commit terrorism. His trial took place before a military commission. The rules governing the commission provided that evidence could be withheld from the accused and his counsel, for "the protection of classified information, the physical safety of participants and witnesses, the protection of intelligence and law enforcement sources, methods, or activities, and other national security interests." Hamdan, 548 U.S. at 614.

The Supreme Court recognized that there is a considerable danger posed by terrorism. Id. at 623. Nonetheless, the Court found that the defendant's trial before a military commission without the defendant being present or hearing the evidence against him was legally unsupportable. Id. at 625.

If alleged terrorists are entitled to see classified and other evidence of high national security importance, then Appellants here should have been allowed to see highly relevant unclassified training materials that pose absolutely no security threat.

The trial court erred by preventing the disclosure of training materials that are unclassified and would be available under an OPRA or FOIA request or even the Internet. There is no legal justification for trial court's endorsement of the State's attempts to keep public documents secret. The trial court should have instead required the State to turn all training

materials over to the Appellants and their experts for review. Failure to do so prejudiced the Appellants and prevented them from presenting evidence concerning the lack of security for the State's DREs.

c. The Trial Court Erred by Refusing to Allow Dr. Roger Johnston to Review the Seal Use Protocol Training Materials.

Finally, the trial court erred by refusing to allow Dr. Johnston to review all of the materials submitted by the State. Appellants' expert, Dr. Johnston, should have been permitted to review the materials, regardless of their "Law Enforcement Sensitive" designation.

The U.S. government entrusts Dr. Johnston to investigate physical security matters concerning national security. (Johnston Test., 4/21 Trial Tr. 15:4-16:13.) He has "top secret" security clearance, the highest level available. (Id. at 11:14-12:4.) Within this "top secret" security clearance designation, his security level was upgraded since the trial to "top secret/SCI." (10/14/10 Johnston Cert. ¶37; Pa457.) He was the only witness to discuss seal use protocols at trial, and his testimony concerning seal use protocol is the only evidence in this case. (See Johnston Test., 4/21 Trial Tr. 63:22-66:9, 80:6-81-22.) He thus should have been permitted to review and comment on all of the State's proposed training materials.

Rather than simply accepting Mr. McLeod's opinion, the trial court should have used Dr. Johnston's review and comments to determine whether the State complied with the Court's March 8, 2010 order to create a seal use protocol. By her own admission, the trial court required such assistance. As she herself stated, "I'm not an expert in seals." (9/23/2010 Hr'g Tr. 34:3-4.)

Because Dr. Johnston was the only expert witness at trial who testified about and defined seal use protocols, his testimony on this matter is the only standard that should have been used to evaluate the State's proposed seal use protocol materials. Instead, the trial court ignored his expertise and accepted the opinion of Mr. McLeod, whose credentials in the area of physical security are questionable.

In sum, the events that took place in the Gusciora case after March 8, 2010 clearly demonstrate that the trial court's orders to improve the security of the State's voting machines have gone unmet. The trial court's failure to enforce her orders has left voters with insecure, unreliable voting machines.

In addition, the Court's failure to enforce her own order has prejudiced the Appellants. As a result, for more than a year, Appellants could not appeal the trial court's seriously flawed decision.

B. This Court Should Take Judicial Notice Of Zirkle v. Henry Because It Shows That The Trial Court Was Wrong About The Reliability And Accuracy Of The State's DREs.

Under 201(b)(4), facts that are referenced in court records are to be judicially noticed. This includes the facts that Appellants seek to use in the Zirkle case.

Additionally, as "sources whose accuracy cannot reasonably be questioned" under N.J.R.E. 201(b)(3), hearing transcripts, certifications and Court orders from the Zirkle case should be judicially noticed by this Court.

Those include the Certification filed by Prof. Appel dated September 18, 2011, who examined the flawed DRE used in Cumberland County, as well as the July 5, 2011 Certification of Lizbeth Hernandez of the Cumberland County Board of Elections.

The events in Cumberland County call into question the trial court's factual findings and legal conclusions about the accuracy of the State's DREs. This Court should take judicial notice of these documents because Appel and Hernandez certified statements show that procedures to safeguard New Jersey's voting machines, which were ordered by the trial court on March 8, 2010, are not implemented.

Under Planned Parenthood v. Farmer, courts may take judicial notice of information in articles. Planned Parenthood v. Farmer, 165 N.J. 609, 640 (2000). As such, events in the

Zirkle case that were detailed in news articles may thus be judicially noticed by this Court. Similarly, events in the Zirkle case can be classified as "of generalized knowledge" under 201(b)(3), and generally known under 201(b)(2) if they were the subject of news articles, as many of them were. For example, the *News of Cumberland County* published several articles regarding the Zirkle litigation between June and September 2011. See Greg Adomaitis, The News of Cumberland County, "Fairfield candidates contest election results, blaming touch-screen machines." June 20, 2011; see also Greg Adomaitis, The News of Cumberland County, "Electronic voting case prompts new election, investigation in Fairfield." September 1, 2011. Because many of the events in the Zirkle case are detailed in court records as well as newspaper articles, the Court should take judicial notice of these facts.

Under N.J.R.E 201(a), law which may be judicially noticed includes the decisional law of New Jersey and determinations of all governmental subdivisions and agencies thereof. This would include Judge Krell's orders and opinion in Zirkle, as well as documents that could be classified as determinations of Cumberland County voting officials or the Attorney General. This Court should take judicial notice of events and issues in the Zirkle case that were addressed in decisional law and government agency determinations.

Information regarding the Zirkle case should be judicially noticed by this Court because it is generally known and referenced in Court records, decisional law and government agency determinations. That information shows that the trial court's findings about election procedures and voting machine security are seriously flawed. The consequences of having no real security measures were serious in the Zirkle case, where the wrong candidates were declared victors of an election on the night of the election. The Zirkle case demonstrates that DREs can misattribute votes anywhere in the State, and that there are no safeguards to catch this misattribution.

1. The Trial Court Made A Reversible Factual Error By Drawing Broad Conclusions About The State's Voting Machine Security And Procedures Based On One County Worker's Testimony. A Recent Invalidated Cumberland County Election Further Illustrates The Trial Court's Error.

The trial court erred by making broad and sweeping generalizations about the preparation, storage and security of the State's voting machine before, during and after each election. See generally Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. Feb. 1, 2010) (slip op. at 157-163; Pa298-304.) The trial court implied that security measures exist throughout the state even though this is not the case. The trial court's findings, however, were based on the testimony of only one witness, James Clayton, who works solely in Ocean County,

running the warehouse where voting machines are stored. Clayton Test., 2/26 Trial Tr. at 178:9-16, 180:22-25,182:5-12.

The procedures followed in Ocean County are not followed by New Jersey's other 20 counties. Indeed, Robert Giles, the Director of the New Jersey Division of Elections, testified that there is no uniform statewide policy regarding storage procedures and transportation of the DREs. (Giles Test, 3/3 Trial Tr. at 152:21 to 153:16.) He also testified that the State does not mandate a uniform procedure for conducting voting machines pre-election testing. (Giles Test., 3/3 Trial Tr. at 154:3-11.) Further, Giles testified that while there is a statewide board worker training manual, it does not contain specifics about the DREs and no one from the Division of Elections investigates poll worker compliance with the training manual. (Giles Test., 3/3 Trial Tr. at 155:3-17 and 155:20-23.)

Recent events in Cumberland County demonstrate the magnitude of the trial court's error in universalizing the practice of one county. During the June 7, 2011 Democratic primary election in Cumberland County, the Sequoia AVC Advantage used in District 3, attributed votes to the wrong candidates.

In that election, Ernest and Cynthia Zirkle ran against Vivian and Mark Henry. Only 43 people voted and 86 votes were cast. (June 7, 2011 Official Election Results Report Tape; Pa1657-58.) According to the election results report generated

by the DRE, Cynthia Zirkle received 10 votes, Ernest Zirkle received 9 votes, Vivian Henry received 34 votes and Mark Henry received 33. (Ltr. From State dated 7/24/11; Pa658.) After the election, several voters in the district approached the Zirkles, confused by their loss. These voters told the Zirkles that they had cast their votes for them. In total, 28 registered voters signed affidavits certifying they had voted for the Zirkles. (See June 7, 2011, Petition to Declare Election Void and No Effect.) Something clearly went wrong with the DRE. The Zirkles, represented by Appellants' counsel in this case, filed suit. Judge Krell heard arguments for Zirkle v. Henry in Cumberland County Superior Court, Law Division.

Judge Krell ordered a new election. On September 26, 2011 in a special election, the Zirkles took home thirty-three percent of the vote over the seventeen percent that went to the Henrys. Greg Adomaitis, Zirkles Win Fairfield Election, September 27, 2011, http://www.nj.com/cumberland/index.ssf/2011/09/zirkles_win_fairfield_election.html.

The documents submitted by Cumberland County Officials demonstrate that Judge Feinberg was wrong to attribute the procedures of one county to all 21 counties in New Jersey. Indeed, Lizbeth Hernandez, the Administrator of the Cumberland County Board of Elections and programmer of the Sequoia AVC

Advantage DREs, certified that the Sequoia AVC Advantage DRE used in Cumberland County was incorrectly programmed.[44] (7/5/11 Hernandez Cert. ¶3, Ex. A June 24, 2011 Ltr; Pa1638-40.) Contrary to Judge Feinberg's declaration of strong statewide procedures, (Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. Feb. 1, 2010) (slip op. at 157-63; Pa298-304.), no procedures existed to catch the mistake, including the pre-LAT test. (7/5/11 Hernandez Cert. Ex. A, June 24, 2011 Ltr. p. 2; Pa640.)

Given that Judge Feinberg's opinion went into great detail about Mr. Clayton's testimony making it seem like these procedures were practiced across all counties, Judge Krell was very concerned and puzzled how Cumberland County officials did not catch the programming error. (Zirkle v. Henry, September 1, 2011 Tr. 46:19-47:3; Pa1714). Appellants have prepared a chart highlighting the discrepancies between the generalizations of state-wide procedure made by Judge Feinberg and what actually occurred in Cumberland County during an actual election.

The chart shows that Judge Feinberg's conclusions about the security and accuracy of the AVC Advantage 9.00H are wrong. The chart shows how Judge Krell found that Judge Feinberg's

[44] Judge Krell referred the Zirkle matter to the Attorney General's Office for criminal investigation to determine whether the programming error was deliberate or purposeful. His referral was prompted by the "scrubbing" or erasure of all evidence from the DRE, while it was impounded, the day before Prof. Appel was scheduled to examine it.

conclusions did not hold true in Cumberland County. On the left, the chart highlights excerpts of Judge Feinberg's opinion that discuss the Ocean County procedures that the trial court universalized making it seem that they were state-wide procedures. As the right column demonstrates, Judge Feinberg's findings cannot be attributed to all counties. The column on the right draws from the certifications submitted in the Zirkle case and the court records for the proceedings held for the failed Cumberland County June 2011 elections.[45]

a. The Trial Court Erred In Finding That The Sequoia Advantage DREs Do Not Have Design Flaws That Cause Votes To Be Lost, Do Not Encourage Voters And Poll Worker Error And Do Not Permit Fraudulent Manipulation.

In evaluating the June 7, 2011, Cumberland County election, Judge Krell found that the way elections are conducted in Cumberland County do not match Judge Feinberg's findings in her February 1, 2010, opinion.

[45] Lizbeth Hernandez, the Administrator of Cumberland County Board of Elections, provided her certification that the programming error was a result of human error and lack of procedures (July 5, 2011); Prof. Andrew Appel provided a certification after he had the opportunity to inspect the Sequoia AVC Advantage voting machine, as well as all documents pertaining to the election, including the winEDS laptop. (August 18, 2011.) Finally, Judge Krell heard testimony regarding the Cumberland County June 2011 election on September 1, 2011. That transcript is discussed.

Trial Court's Conclusions	Cumberland County Court Conclusions
Judge Feinberg: "There is no evidence that the AVC in its normal state: (1)has design flaws that cause votes to be lost (2)encourages voter and poll worker error; or (3) permits fraudulent manipulation." Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. Feb. 1, 2010) (slip op. at 174; Pa315.)	**Judge Krell:** "The way the machine was programmed or alternatively, some alteration took place, someone altered what was done. The votes that were cast at the election were not properly reflected in the results that were certified to the Clerk." (Zirkle v. Henry, 9/1/11 Trial Tr. at 6:21-7:1; Pa1694.)
"The software design of the AVC does not cause any votes to be miscounted." (Id. at 174; Pa315.)	"As a result of human error in the programming of the voting machine used in this election, the votes cast for Cynthia and Ernest Zirkle registered for Vivian and Mark Henry." (7/5/11 Hernandez Cert. ¶ 3; Pa1638.)
"The court finds that voting rights are not severely restricted by the use of paperless voting machines. First, the court finds that absent pre-meditated criminal activity, the voting systems in this State are safe, accurate and reliable. . . . Second, there is no evidence of tampering of an AVC in any election in this State or any impermissible alteration of any vote." (Id. at 193; Pa334.)	**Judge Krell:** "The votes that were cast at the election were not properly reflected in the results that were certified to the Clerk." (Zirkle, 9/1/11 Trial Tr. at 6:24-7:1; Pa1694.) **Judge Krell:** "Something went wrong. We know something went wrong." (Id.) at 14:1; Pa1698. **Judge Krell:** "It is clear that the election at issue was defective and must be voided by the court." (Id. at 53:14-16; Pa1717.)

b. The Trial Court Incorrectly Held That No AVC Advantage Has Ever Been Hacked, And That DREs Have No Known Design Flaws.

The Sequoia Advantage 9.00H has known design flaws that were uncovered by Prof. Appel. In New Jersey, DREs are not tested either before or after each election. As Judge Krell concluded, there is no way to know if other AVC Advantage voting machines have ever been compromised.

Trial Court's Opinion	Cumberland County Election
"(1) No AVC has ever been demonstrated to have been hacked . . . in this State or any other state. (2) There has never been a demonstrated incident of an attempted attack or a verified attack of any AVC voting system in the United States since its use began at least as early as 1979." (Gusciora, slip op. at 171 (Law Div. Feb. 1, 2010); Pa312.)	Mr. Cohen, Assistant Attorney General: "First, to put it into perspective; of all the elections that occurred on June 7, none of them had [a] problem. This one did. . ." **Judge Krell:** "Well, you know what? We don't know that. We have no way of knowing that. . . . You haven't checked these other elections." (Zirkle, 9/1/11 Trial Tr. at 38:12-39:1; Pa1710.)

c. The Trial Court Erred By Universalizing The Testimony Of One Witness To Draw Conclusions About Election Preparation And DRE Programming Throughout The State.

The excerpts under "Cumberland County Procedures" demonstrate how election procedures that Judge Feinberg presented in her March 8, 2010, order as being practiced state-

wide are not. They are based on the testimony of only one warehouse worker and are not in fact in place throughout the State.

Judge Feinberg's Opinion/Order	**Cumberland County Procedures/Election**
"The Clerk in each county prepares the ballot definition. The ballot definition includes the name of the candidates, the names of the contests and identifies the buttons on the AVC that correspond to each candidate. When the ballot definition information is completed, it is copied to a results cartridge . . . using an ordinary laptop computer. . . . Once the transfer is complete . . . each results cartridge is placed . . . in the voting machine." (Gusciora, (slip op. at 158-159) (Law Div. Feb. 1, 2010) (*discussing voting procedures in New Jersey*); Pa299.) "Once the cartridge is placed into the machine, the election worker turns on the machine . . . [and] the operator panel instructs the computer in the machine to copy the data ballot information into the internal memory of the machine." (Id. at 159, Pa300.)	**Judge Krell:** "Judge Feinberg, in her very lengthy Decision went into great detail as to how the A[V]C Advantage works and the various testing procedures that are available to avoid the type of problem and mistakes, which the Administrator claims occurred in this case. . . . [this] Court raised a number of questions as to the Administrator's claim that these erroneous results were simply the result of human error." (Zirkle, 9/1/11 Trial Tr. at 46:19-47:3; Pa1714.) "I received the necessary data as usual for me to begin programming the election. It is with this information that I have always followed to program the electronic voting machines. . . . I mistakenly placed the position for Vivian and Mark Henry onto the position of Cynthia and Ernest Zirkle and vice-versa. I then created the voting machine cartridge and sent it to our warehouse for testing." (Hernandez Cert. Ex. A,

	June 24, 2011 Ltr; Pa1639-41.)
"The operator panel prompts the technician through each step of the set-up diagnostic process. . . . The write-in keyboard, switches, lights, keys and other components are checked. Lastly, the buttons are pressed and the lights compared to the names on the ballot." (Id. at 17; Pa158.)	"At that point, the voting machine technicians inserted the cartridge into the voting machine and began the necessary testing. Along with hardware and software tests that are performed, this examination involves the technicians pushing every button for the contests, candidates, and personal selections to check for accuracy. Like me, these voting machine technicians . . . did not catch the error that I had made." (Id.)
"In Pre-LAT, election official, consultants, or third party vendors test the ballot definition to make sure the names are printed over the right buttons. . . . Pre-LAT, in essence, is a mock election in which election staff or third party vendors/consultants cast votes for different candidates and then print the results to compare the totals." (Id. at 159; Pa300.)	"There was that pre-lat done. What the technicians missed is where they actually pushed the button to hear people's names, to hear the candidate's name. That's their mistake. That's where they missed the Zirkle mistake." (Zirkle, 9/1/11 Trial Tr. at 32:22-33:2; Pa1707.)
Judge Feinberg: "Election staff prepares the voting machines for the election. Conducted through the operator panel, by way of prompts that follow a sequence of commands to test the various components of the voting machine." (Id.	**Judge Krell:** "We have a lack of proper procedures or incompetence in doing the pre-lat test that would have picked up a mistake by the administrator in the programming under the Win EDS." (Zirkle, 9/1/11 Trial Tr. at 37:6-9;

at 159; Pa300.)	Pa1709.)

d. The Trial Court Erred In Finding That Voting Machines Are Stored In Secured Warehouses Throughout the State.

While the trial court concluded that all voting machines are stored in a secured warehouse, as is evidenced by Cumberland County, there is no election machine storage and post election procedures to ensure the security of the DREs. That is the case even with DREs that have been impounded pursuant to Court Order.

Trial Court's Opinion	**Cumberland County Election**
"In all of the counties, the voting machines are stored in a warehouse either owned or rented by the county." (Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. Feb. 1, 2010) (slip op. at 160; Pa301.)	The voting machine "warehouse" is in a room at the back of Cumberland County Board of Elections with no security. (8/18/11 Appel Cert. at ¶ 5; Pa1628.)
"Each of the buildings where voting machines are stored is equipped with an alarm system, and each election staff member requires a unique code for access and a unique code for the alarm system." (Id.)	"Upon entry to the room, I observed that there was no logging of who entered and left the room, that is none of us had to sign in or out, and no apparent records were kept as we entered and exited." (Id.)
"Keys for voting machines are maintained in locked cabinets. Laptops and results cartridges used by the warehouse are maintained in locked cabinets and storage areas." (Id. at 161; Pa302.)	"I asked to examine such computer(s). Ms. Hernandez led me into a small conference room immediately adjacent to the front lobby. As the time we approached this room, the door to the room was open and no one was inside." (Id. at ¶ 9; Pa1629.)

This chart makes clear that the trial court erred by universalizing the procedures that are in practice in only one county. The lower court drew broad conclusions about voting machine security based on the testimony introduced at trial by one warehouse worker. The chart also shows the trial court's ultimate conclusion on safety and security of the Sequoia AVC Advantage voting machines are wrong. Her conclusions are not supported by any evidence.

This Court should take judicial notice of the Zirkle case as well as events in the post-trial phase of the Gusciora case. These events demonstrate that the trial court made serious legal and factual errors. These errors perpetuate the insecurity and vulnerability of the State's DREs to tampering and programming mistakes. These events also demonstrate that the franchise in New Jersey is not protected.

The Zirkle case in particular shows that DRE errors can result in losing candidates being declared victors. It was fortuitous that the Zirkles discovered that a tabulation error had occurred. It was only because fewer than 30 voters cast their ballots. In larger election districts where many more votes are cast, or where voters do not personally know candidates, it is almost certain that DRE vote misattribution would be discovered.

VI. WHEN CONSTITUTIONAL ISSUES ARE AT STAKE, COURTS MAY AND SHOULD COMPEL SPECIFIC PERFORMANCE, EVEN IF SUCH AN ORDER REQUIRES THE APPROPRIATION OF FUNDS.

A. This Court Has The Constitutional Authority To Mandate That Funds Be Set Aside To Implement The Voter Verified Paper Ballot Requirement.

The State, through its failure to put into place auditable voting systems, has made clear that it will not fund the New Jersey Legislature's voter-verified paper ballot mandate, unless it is compelled to do so. Thus, it is critical for this Court to order that the State purchase voting systems that comply with the State's voting rights laws.

The New Jersey Supreme Court has held repeatedly that where a constitutional right is in danger of being violated, the judiciary has the authority and duty to direct the legislature how to appropriate State funds. Robinson v. Cahill, 69 N.J. 133 (1975), is the seminal case in that regard. Robinson provides authority for this Court to direct the Legislature to appropriate monies to rectify New Jersey's insecure and inaccurate DREs to produce a voter verified paper ballot. In Robinson, the New Jersey Supreme Court held that the courts are obligated to act when the other branches of government fail to protect a constitutionally guaranteed right. Id. at 139-40. In fact, the opening sentence of the Robinson decision states emphatically that "[t]he Court has now come face to face with a constitutional exigency involving, on a level of plain, stark and unmistakable

reality, the constitutional obligation of the Court to act." Id. at 139.

In Robinson, plaintiff parents showed that the defendants failed to ensure the constitutional mandate that all children receive equal educational opportunities. See id. at 141 (citing Robinson v. Cahill, 62 N.J. 473, 515 (1973)). They argued that the defendants failed to provide for the maintenance and support of a constitutionally mandated "thorough and efficient" system of free public school education for all children. Id. at 143-44. As a remedy, the Court ordered the legislature to disburse educational funds according to a particular formula taken from previous legislation to ensure that all students received equal educational opportunities. Id. at 150-51.

The Robinson court rejected the defendants' argument that judicial intervention in appropriations from the State Treasury violated the separation of powers doctrine. Id. at 151-53. The Court provided several reasons for doing so. The Court noted that the legislature cannot curtail the constitutional rights of citizens through its inaction. Id. at 156. The Court also found that the New Jersey judiciary has traditionally taken "affirmative judicial action" to protect constitutional rights. Id. at 152 (citing Jackman v. Bodine, 43 N.J. 453 (1964) ("Jackman I"); Swann v. Charlotte-Mecklenburg Bd. of Educ., 402 U.S. 1 (1971); Griffin v. School Bd. of Prince Edward County, 377

U.S. 218, 233-34 (1964); Hawkins v. Shaw, Mississippi. 437 F.2d 1286 (5th Cir. 1971); Kennedy Park Homes Ass'n v. Lackawanna, N.Y. 436 F.2d 108 (2d Cir. 1970), certif. denied 401 U.S. 1010 (1970); Mills v. Bd. of Educ., 348 F. Supp. 866 (D.D.C. 1972)). The Court noted that:

> When there occurs such a legislative transgression of a right guaranteed to a citizen, final decision as to the invalidity of such action must rest exclusively with the courts. It cannot be forgotten that ours is a government of laws and not of men, and that the judicial department has imposed upon it the solemn duty to interpret the laws in the last resort. However delicate the duty may be, we are not at liberty to surrender, or ignore, or to waive it.

Id. at 147 (quoting Asbury Park Press. Inc. v. Woolley, 33 N.J. 1, 12 (1960)). The Court further noted that the judiciary's responsibility to safeguard the rights of individuals is "as old as this country." Id. at 147 (quoting Marbury v. Madison, 1 Cranch 137 (1803)). Finally, the Court found that:

> This Court, as the designated last-resort guarantor of the Constitution's command, possesses and must use power equal to its responsibility. Sometimes, unavoidably incident thereto and in response to a constitutional mandate, the Court must act, even in a sense that seems to encroach, in areas otherwise reserved to other branches of government.

Id. at 154 (quoting Powell v. McCormick, 395 U.S. 486 (1969)).

The New Jersey Supreme Court determined that immediate judicial intervention was necessary, even though there were

indications that the Legislative and the Executive branches had already begun to correct for the constitutional deficiency. Id. at 146-47. That the Legislature had begun to take steps only affected the duration of the Court's provisional remedy. Id. at 146.

The Court also found that where there is a "theoretical conflict" between the New Jersey Education Clause and the New Jersey Appropriations Clause, it was the Court's duty to enforce the Education Clause. Id. at 154. That same principle applies here. The integrity of the franchise should not be compromised in perpetuity because of the State's unfortunate fiscal situation.

New Jersey courts have fashioned very specific remedies for the legislature in a number of instances, including where the right to vote was being compromised. In Jackman I, the Court determined that the New Jersey Legislature was not apportioned in a way that protected the right of "one person, one vote" as guaranteed by the state constitution. Jackman I, supra, 43 N.J. at 459. The Court took the bold but necessary step of enjoining all elections until the defendants' apportionment system was changed. Id. at 478. In Jackman I, the Court directed the Legislature to devise a new apportionment system through a constitutional convention. Id. The Court reserved the right to intervene if the Legislature did not make the appropriate changes

within a limited time frame. Id. This very specific remedy was affirmed in Jackman v. Bodine, 44 N.J. 312 (1965) ("Jackman II").

The New Jersey Supreme Court's holdings in Robinson and both Jackman opinions clearly apply to this case. First, as in both Robinson and Jackman I, the right at stake here (the right to vote) is fundamental and protected by the New Jersey Constitution. See N.J. Const. art. II, § 1, ¶ 3. Because it is impossible to know whether New Jersey's DREs are counting votes correctly, they violate the right to vote and to have one's vote counted accurately, which are guaranteed by the New Jersey Constitution and Title 19. See, e.g., New Jersey Democratic Party v. Samson, 175 N.J. 178, 187 (2002) (citing Reynolds v. Sims, 377 U.S. 533, 555 (1964) (implicit to right to vote is right to have vote counted as cast)).

Second, as in Robinson and Jackman I, the constitutional right is being violated statewide. All of New Jersey DREs are unreliable, not thoroughly tested and insecure. They do not, and cannot, produce a voter-verified paper ballot, which makes them unauditable. The overwhelming evidence presented at trial shows that there is no way to know whether the 11,000 Sequoia Advantage DREs are counting or manipulating votes. Such uncertainty and utter lack of transparency in voting severely compromises the right to vote. The Court in Robinson stated that

where a fundamental right guaranteed by the state constitution is at stake, the court must "afford an appropriate remedy to redress a violation of those rights. To find otherwise would be to say that our Constitution embodies rights in a vacuum, existing only on paper." Robinson, 69 N.J. at 347 (quoting Cooper v. Nutley Sun Printing Co., Inc., 36 N.J. 189, 197 (1961)).

Third, the Court in Robinson and Jackman I took action after the legislative and executive branches failed to correct the constitutional defects in the State's education system. In Robinson, the Court's remedy was in the form of provisional relief. The Court required that educational funding for the 1976-1977 academic year be revised according to a new formula. If the Legislature resolved the issue of unequal education before the end of that year, then a judicial remedy would no longer be required.

The Court devised a similar remedy in Jackman I. The Court established time limits for the Legislature to correct for its inadequate representation and structure through a constitutional convention. Jackman I, supra, 43 N.J. at 476-77. The Court found that if the issue of unequal legislative apportionment remained unresolved after the convention, it would intervene by adopting and enforcing a plan of its own design. Jackman II, supra, 44 N.J. at 316-17. The Court determined even "the call of a constitutional convention is not a fact which would relieve us

from our obligation to abide by the mandate of the highest court in the land." Id. at 316.

Like in Robinson and Jackman I, this Court has the authority to fashion a remedy to protect the constitutionally guaranteed right to vote. This Court also has the authority to mandate that funds be set aside to bring New Jersey voting machines into compliance with the New Jersey Constitution and Title 19. This is particularly true because the voter verified paper ballot law is still in effect. The Legislature never repealed the statute, even though it had the opportunity to do so multiple times.

The protection of voting rights falls squarely within the authority of the judiciary. Title 19 specifically authorizes the judiciary to ensure that approved voting systems are reliable and comply with fifteen specific security requirements in N.J.S.A. 19:48-1(a) to (o). Furthermore, N.J.S.A. 19:48-2 charges the judiciary with reviewing the certification of voting machines.

As the Appellees' Chief Election Officer, the Secretary of State is charged with protecting the right to vote by ensuring that all voting machines are equipped to produce a voter-verified paper ballot. When the Chief Election Officer fails to honor that obligation, as has been the case for seven years, since the voter verified paper ballot law was enacted, the judiciary may, and indeed is obligated, to intervene.

In fact, New Jersey courts have intervened in elections, which are ordinarily under the auspices of the executive branch, to protect the integrity of the electoral process. For example, courts have consistently set aside elections where there is evidence of tainted results caused by malfunctioning voting machines. When machines fail to work properly, judicial action is necessary to protect New Jersey voters' constitutionally protected rights. See, e.g., In re Petition of Hartnett, 163 N.J. Super. 257, 268 (App. Div. 1978); In re the Application of Moffat, 142 N.J. Super. 217, 222 (App. Div. 1976) (ensuing court intervention when a voting machine malfunction caused a recording mechanism within the voting machine to become dislodged); In Re the 1984 General Election for the Office of Council of the Township of Maple Shade, 203 N.J. Super. 563 (Law Div. 1985) (setting aside election even though alternative voting methods, such as emergency ballots, were available to voters, because those voting measures were not properly implemented).

It is within both this Court's legal and expansive equitable powers to provide relief in furtherance of the public interest. Texas Co. v. Di Gaetamo, 71 N.J. Super. 413, 430 (App. Div. 1962) (quoting Mercoid Corp. v. Mid-Continent Inv. Co., 320 U.S. 661, 670 (1944) (internal quotations omitted)). Clearly, there is no greater public interest than preserving our fundamental

right to vote, which is being violated by the 11,000 Sequoia AVC 9.00H Advantage DREs used throughout the State.

B. Specific Performance Is Appropriate Here, Where The State Made Repeated Misrepresentations To The Legislature, This Court, And The Trial Court That It Would Comply With The Voter-Verified Paper Ballot Requirement.

Because the constitutional right to vote is at issue in this case, this Court should compel the State to put in place auditable voting machines. This Court should take action to protect the franchise, and should refuse to allow the State to use misrepresentations to continue to delay compliance with its mandate to provide more secure and reliable voting machines.

Courts do not look kindly upon misrepresentations made by the State, particularly when constitutional rights are at issue. This is demonstrated by the New Jersey Supreme Court's most recent decision in the ongoing litigation in Abbott v. Burke, where the Court rebuked the State for failing to honor its commitment to fully fund education for students in New Jersey, after the State "persuaded [the Court] to give it the benefit of the doubt." Abbott v. Burke, 206 N.J. 332, 341 (2011) ("Abbott XXI"). The State has made misrepresentations of a similar nature in this case, by stating repeatedly that it would comply with the statutory mandate to provide voting machines with voter verified paper ballots, and then failing to do so.

In 2009, in Abbott v. Burke, 199 N.J. 140, 146-47 (2009) ("Abbott XX"), the State asked for and was granted relief from the Supreme Court's oversight of the State's obligations to provide a thorough and efficient education to all students. The State promised to implement a school funding plan, the School Funding Reform Act of 2008 (SFRA), that it presented to the Supreme Court for approval. Id. at 175.

Two years later, in Abbott XXI, the New Jersey Supreme Court excoriated the State for failing to fund the court-approved project because the State could not afford to do so. As the Court stated:

> In respect of the failure to provide full funding under SFRA's formula to Abbott districts, the State's action amounts to nothing less than a reneging on the representations it made when it was allowed to exchange SFRA funding for the parity remedy. Thus, the State has breached the very premise underlying the grant of relief it secured with Abbott XX.

Abbott XXI, supra, 206 N.J. at 341. In addition, the Court noted that the State "directly contravened representations made by the State when procuring relief from prior judicial remedial orders . . . . The State has breached the very premise underlying the grant of relief it secured with Abbott XX." Id. at 359-60.

The State pulled a similar sleight-of-hand here. In July 2005, the State of New Jersey enacted a statute that required

all voting machines to "produce an individual permanent paper record of each vote cast" by January 1, 2008. N.J.S.A. 19:48-1. This statute provided the Attorney General authority to grant a waiver only "if the technology to produce a permanent voter-verified paper record for each vote cast is not commercially available." Id.; see also N.J.S.A. 19:53A-3.

In 2006, after the first oral argument before this Court, the case was remanded to the trial court for an expedited determination of two issues: 1) whether technology existed to implement the newly-passed voter verified paper ballot law; and 2) under what circumstances would the State consider extending the deadline. (Court Order, Gusciora v. McGreevey, No. MER-L-2691-04 (Law Div. Feb. 9, 2006) (slip op. at 7).) Judge Feinberg subsequently found in 2006 that the technology existed to produce a VVPAT to meet the January 2008 deadline, but that only one company, Avante, manufactured a machine with VVPAT that was commercially available and certified in New Jersey. (Gusciora v. McGreevey, No. MER-L-2691-04 (Law Div. April 19, 2006) (slip op. at 29).) Judge Feinberg in the same opinion noted that N.J.S.A. 19:48-1 "does not provide a 'waiver' based on monetary considerations." (Id.) at 48.

For two years, on a monthly basis, the State misrepresented to the trial court that it would meet the January 2008 deadline:

- At trial, the State represented that it "intends to see the VVPAT implemented on the State's voting machines in compliance with P.L. 2005, c. 137 by January 1, 2008." Gusciora v. McGreevey, No. MER-L-2691-04 (Law. Div. April 19, 2006) (slip op. at 41) (citing Def.'s Br. at 25-26).

- Judge Feinberg found that the "Administration and the Attorney General have represented in court a commitment to implement the statutory mandate to provide a VVPAT and the related requirements by January 1, 2008." (Id. at 48.)

- This Court also found that the State represented that it would comply with the VVPAT requirements by January 2008. Gusciora v. McGreevey, No. MER-L-2691-04 (App. Div. Sept. 6, 2007) (slip op. at 9). As a result, this Court sent the case back to Judge Feinberg to monitor the State's compliance with its obligations to provide voting machines equipped with VVPAT. Id.

- On the eve of the January 2008 compliance deadline, the State revealed that it would not meet the January 2008 deadline, and the Attorney General recommended the continued use of DREs, "pending final certification of new voting machines equipped with VVPAT." Gusciora v. Corzine, No. MER-L-2691-04 (Law Div. Feb. 1, 2010) (slip op. at 9); Pa150. This created the impression that the State intended to comply, as soon as the certification process was complete. The State petitioned the Legislature to delay the deadline. As a result, the VVPAT compliance deadline in January 2008 was extended to June 2008. (Id. at 10 (citing P.L. 2007, c. 301 (S-2949)); Pa151.)

- In February 2008, the Attorney General announced that the State would miss the June 2008 deadline for compliance with the statutory mandate for VVPAT implementation,

> and asked for another extension.[46] Because of the State's failure to comply, the Legislature extended the deadline again, to January 1, 2009. P.L. 2008, c. 18 (A-2229). The State missed all of these deadlines.

As the coupe de grace, after the last trial in this case started, the State petitioned the Legislature to extend the deadline indefinitely, until funding became available. In March 2009, the Legislature obliged. N.J.S.A. 19:53A-3(i)(2).

As a result of the State's repeated actions, the legislative mandate protecting the integrity of the franchise cannot be implemented. As of August 2010, New Jersey was one of only seventeen states using paperless direct recording electronic voting machines, and one of only six that uses these insecure voting machines statewide.[47] Congressman Rush Holt, et. al., Letter to Attorney General Eric Holder, Aug. 13, 2010.

By making repeated misrepresentations over a number of years to this Court and the trial court regarding its intention

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[46] Another Delay for Electronic Ballot Safeguards, NJ.com, Feb. 21, 2008, http://www.nj.com/news/index.ssf/2008/02/another_delay_for_nj_electroni.html.

[47] Although the decision was ultimately vacated as moot when the State of Ohio voluntarily abandoned all of the challenged voting machines, 473 F.3d 692 (6th Cir. 2007), it has since been cited to, see, e.g., Paralyzed Veterans of Am. v. McPherson, 2008 U.S. Dist. LEXIS 69542 (N.D. Cal. Sept. 8, 2008), and followed, see, e.g., United States Student Ass'n Found. v. Land, 585 F. Supp. 2d 925 (E.D. Mich. 2008), stay denied by, 2008 U.S. Dist. LEXIS 87500 (E.D. Mich. 2008), motion granted by, stay denied by, 546 F.3d 373 (6th Cir. 2008), for various propositions of law.

to comply with the statutory mandate for VVPAT implementation, the State was ultimately able to suspend indefinitely its duty to protect the integrity of the franchise in New Jersey. Abbott XXI makes clear that courts will not tolerate such misrepresentations, particularly when, as in this case, constitutional rights are involved. Abbott XXI, supra, 206 N.J. at 360-61. Because voting is the most fundamental constitutional right, this Court should not permit the State to dodge its obligation to provide secure and auditable voting machines to New Jersey voters.

C. It Is Incumbent On This Court To Make A Final Determination Of The Case In The Interest Of Justice.

This Court has broad power over the final disposition of this case using its original jurisdiction under R. 2:10-5. This Court should exercise that authority to conclude this case once and for all.

As a general matter, "[i]n the exercise of its appellate jurisdiction a reviewing court has the power and indeed the duty to make such ultimate disposition of a case as justice requires." E & K Agency, Inc. v. Van Dyke, 60 N.J. 160, 164 (1972). Furthermore, an appellate court's decision to "[r]esort to [their] authority to exercise . . . original jurisdiction is particularly appropriate . . . where there is an emergent matter implicating the public interest." State v. Rose, 173 N.J.

Super. 478, 483 (App. Div. 1980); see also Executive Comm'n on Ethical Standards v. Salmon, 295 N.J. Super. 86, 112 (App. Div. 1996) ("The exercise of [original] jurisdiction is generally reserved for emergent matters implicating the public interest."); Maisonet v. N.J. Dep't of Human Servs., Div. of Family Dev., 140 N.J. 214, 223 (1995).

For instance, in Associated Metals & Minerals Corp. v. Dixon Chemical & Research, Inc., 82 N.J. Super. 281 (App. Div. 1963), the Appellate Division found that the damages awarded to the plaintiff were inadequate. As a result, the Appellate Division exercised its original jurisdiction to "mold the judgment in plaintiff's favor." Id. at 316; see also Giumarra v. Harrington Heights, 33 N.J. Super. 178, 197 (1954), aff'd o.b., 18 N.J. 548 (1955).

Similarly, in Lowenstein v. Newark Board of Education, 35 N.J. 94 (1961), which involved a decision by the Newark Board of Education to dismiss a teacher after a school board vote of 5-4, the Supreme Court decided to dispose the case without remand because two of the votes were based on improper grounds, and because the controversy before it "ha[d] already lasted six years and it [was] in the interest of essential justice that it be finally concluded." Id. at 118. In Wilde v. Wilde, 341 N.J. Super. 381, 399 (App. Div. 2001), which involved a protracted child visitation dispute between a mother and her children's

grandparents, the Appellate Division decided to exercise original jurisdiction in order to conclude the proceeding without further cost and disruption, rather than remand the case.

This lawsuit seeks to protect the public interest. It seeks to protect the constitutionally guaranteed right to vote, the most fundamental of our constitutional rights. See In re Attorney General's "Directive on Exit Polling: Media & Non-Partisan Pub. Interest Groups", 200 N.J. 283, 302 (2009) ("The right to vote is among the most prized of all rights in a democracy."). In each election in New Jersey, voters are exercising their fundamental right to vote by using the 11,000 Sequoia Advantage DREs. As the evidence shows, these computerized voting machines can be easily manipulated to alter votes and alter the results of elections. The rights of New Jersey voters to cast their votes and have their votes counted, a right secured by the New Jersey Constitution as well as Title 19, are therefore under perpetual threat. In light of this troubling reality, this Court should make a final determination in favor of the Appellants.

This case has been pending for nearly eight years. At this point in time, almost the entire nation, taking heed of computer scientists' published studies about the vulnerabilities of paperless DREs, has switched to using voting systems that use or

produce voter-verified paper ballots. In the interest of justice, this Court should order the State to allocate appropriate funds to effectuate Title 19's voter-verified paper ballot requirement.

CONCLUSION

Appellants have demonstrated that the trial court made significant legal and factual errors. Her findings left the State's 11,000 insecure and unreliable DREs intact. The trial court disregarded robust and unrefuted scientific evidence presented during trial that unequivocally shows that the Sequoia Advantage 9.00H DREs are insecure and can be manipulated to produce illegitimate results with little effort. Access to the State's DREs by hackers is easy because the voting machines are left unattended in polling places for up to two weeks before and after each election.

This case has been in litigation for nearly eight years. That means that several times each year, the citizens of this State cast their ballots on insecure and unreliable DREs. This Court should reverse the trial court's findings and use its de novo power of review to find that the State's more than 11,000 DREs violate the New Jersey Constitution and Title 19.

This Court has the authority, and the obligation, to order a remedy that would protect the integrity of the voting process and the integrity of each vote that is cast. As such, this Court

should order that voter verified paper ballots be put in place before the 2012 presidential election.

Respectfully submitted,

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