

**State of New Jersey**  
**Criteria for Voter-Verified Paper Record for Direct**  
**Recording Electronic Voting Machines**

Pursuant to N.J.S.A. 19:48-1 and N.J.S.A. 19:53A-3, no later than January 1, 2008, each voting machine in New Jersey 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. In the event of a recount, the voter-verified paper records will be the official tally for the election.

To effectuate the intent of the statute, and to instill full public confidence in the electoral process, the Attorney General has established the following criteria for the design and use of a Voter-Verified Paper Record System in conjunction with a Direct Recording Electronic Voting Machine.

**I. Definitions**

Direct Recording Electronic Voting Machine (“DRE”):

A voting machine that records votes by means of a ballot display provided with mechanical or electro-optical components that can be activated by the voter and processes data by means of a computer program. Voting data and ballot images are recorded in internal and external memory components. A DRE produces a tabulation of the voting data stored in a removable memory component and a printed paper ballot.

Voter-Verified Paper Record (“VVPR” or “paper record”):

Physical piece of paper on which the voter’s ballot choices are recorded, cast, and preserved for later use in any recount or manual audit.

Voter-Verified Paper Record System (“VVPRS”):

A system that includes a printer and storage unit attached to, built into, and/or used in conjunction with a DRE. This system produces, stores, and secures voter-verified paper records.

**II. General Description of System<sup>1</sup>**

**A. Components**

A DRE with VVPR capability shall consist of the following components:

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<sup>1</sup> This Criteria is for the use of a VVPRS with a DRE. The issuance of the Criteria does not preclude the use of any other voting system permitted under Title 19 and certified by the Attorney General.

1. Printer: a device that prints the voter's DRE selection on a paper record;
2. Paper Record Display Unit: a unit that allows a voter to view his or her paper record while preventing the voter from directly handling the paper record;
3. Paper: the paper used to produce the voter-verified paper record shall be sturdy, clean, and resistant to degradation; and
4. Storage Unit: a device that securely stores all paper records (including accepted and rejected ballots) during the course of the election and thereafter as required or necessary.

**B. Operation**

1. The VVPRS may be designed in various configurations. In all configurations, prior to casting the ballot, the voter shall have the ability to verify his or her selections on a paper record in a private and independent manner.
2. The VVPRS shall be designed to allow the voter to easily review, accept, or reject his or her paper record.
  - a. The DRE shall not record the electronic record until the paper record has been approved by the voter.
3. VVPRS records may be printed and stored by two different methods:
  - a. "Cut and Drop" Method: The voter views and verifies the paper record, which the VVPRS cuts and drops into a Storage Unit.
  - b. "Continuous Spool" Method: The voter views the paper record on a spool-to-spool paper roll. This method shall be used in a manner that fully protects the secrecy of all votes cast.
4. No electronic or paper record shall indicate the identity of a voter or be maintained in a way that allows a voter to be identified.
5. The electronic and paper records shall be created and stored in ways that preserve the privacy of the record.

6. The VVPRS components shall conform to federal and state accessibility requirements.
  - a. These requirements shall include, but are not limited to, an audio component that shall accurately relay the information printed on the paper ballot to the voter.
7. The VVPRS device shall draw its power from the DRE or the same electrical circuit from which the DRE draws its power.
8. The voting machine shall provide a standard, publicly documented printer port, or the equivalent, using a standard communication protocol.
9. The VVPRS shall mark the paper record precisely as indicated by the voter on the DRE and produce an accurate paper record and corresponding electronic record of all votes cast.
10. DRE electronic ballot image records shall include all votes cast by the voter, including write-ins and undervotes.
  - a. Write-in votes are votes cast by a voter for an individual not listed on the ballot as a formal candidate.
  - b. Undervotes are elective office and/or public questions on the ballot for which the voter has not cast a vote.
11. An electronic ballot image record shall have a corresponding paper record.
  - a. The paper record shall be printed and the voter shall have the opportunity to verify the paper record in its totality prior to the final electronic record being recorded.
  - b. The DRE electronic ballot image record shall correspond to the paper record in a manner that does not reveal the voter's identity.
  - c. The paper record shall contain all voter selection information stored in the electronic ballot image record.

### **III. Design Requirements for a VVPRS**

#### **A. Printer**

1. The printer shall be designed to have a sufficient amount of paper, ink, toner, ribbon or like supply for use in an election, taking into account an election district should have at least one voting machine per 750 registered voters.
  - a. If any addition or replacement of paper, ink, toner, ribbon or other like supply is required, it shall be done with minimal disruption to voting and without circumvention of the security features of the Printer and Storage Unit which protect cast ballots and the secrecy of the vote.
2. The VVPRS shall have a low-paper indicator that will allow for the timely addition of paper so that each voter can fully verify, without disruption, all of his or her ballot selections.
3. The printer shall be secured by security seals or locking mechanisms to prevent tampering. The printer shall be accessed only by those election officials authorized by the county commissioner of registration.
4. The VVPRS shall be capable of showing the information on the paper record in a font size of at least 3.0 mm and should be capable of showing the information in at least two font ranges, 3.0-4.0 mm and 6.3-9.0 mm, under the control of the voter or poll worker. This criteria can be met by providing a magnification device with the VVPRS.

#### **B. Paper Record Display Unit**

1. The paper record shall be displayed in a way that allows the voter to privately and independently inspect it.
2. If the paper record cannot be viewed entirely in the Display Unit at one time, the voter shall have the opportunity to verify the entire paper record prior to the electronic or the paper ballot being stored and recorded.
3. The Display Unit shall have a protective covering which shall be transparent and shall not obscure the voter's view of the paper record. This covering shall be in such condition that it can be made transparent by ordinary cleaning of its exposed surface.

**C. Paper**

1. Any paper record produced by a VVPRS shall be readable by voters and election officials.
2. All paper records shall be stored in accordance with vendor specifications.
3. If stored in accordance with vendor specifications, the paper used to produce a paper record shall be readable for a period of at least two years after the election in which it is used.

**D. Paper Record Storage Unit**

1. Security protections including, but not limited to, security seals or locking mechanisms, shall be built into the Storage Unit to prevent tampering at all times, including pre-election, election day, and post-election. The Attorney General, through the Department of Law and Public Safety (“LPS”), will issue chain of custody guidelines regarding the Storage Unit.

**IV. Procedural and Usability Requirements**

**A. Paper Records**

1. The paper record shall include identification of the particular election, the election district, and the voting machine.
2. The paper record shall include a barcode that contains the human-readable contents (shorthand is acceptable) of the paper record.
  - a. The barcode shall use an industry standard format and shall be able to be read using readily available commercial technology.
  - b. If the corresponding electronic record contains a digital signature, the digital signature shall be included in the barcode on the paper record.
    - (1) A digital signature is extra data appended to an electronic document which identifies and authenticates the sender and message data using public key encryption, or other means approved by LPS.

- c. The barcode shall not contain any information other than an accurate reflection of the paper record's human-readable content, error correcting codes, and digital signature information.
3. For the "Cut and Drop" Method, if the paper record cannot be displayed in its entirety on a single page, each page of the record shall be numbered and shall include the total count of pages for that ballot.
4. The image created on the paper record shall include every contest that is displayed to the voter on the DRE, including write-ins and undervotes.
5. The paper record shall be created such that its contents are machine readable.
6. The paper record shall contain error correcting codes for the purpose of detecting read errors and for preventing other markings on the paper record from being misinterpreted when the paper record is machine read.
  - a. A read error is a separate code or piece of data that can be used to indicate whether the data printed on the paper record is different from the data created on the electronic record.

**B. DRE Electronic Records**

1. The electronic ballot image record and paper records shall be linked by including unique identifiers so that an individual paper record can be identified with its corresponding electronic record. Unique identifiers are tools that will allow LPS to measure the reliability and accuracy of the voting system, as necessary. The electronic ballot image and the paper record shall not reveal the identity of the voter.
  - a. Unique identifiers shall not be displayed in a way that can be easily memorized.
2. The DRE should generate and store a digital signature for each electronic record.
3. The electronic ballot image records shall be able to be exported for auditing or analysis on standards-based and/or COTS (commercial off-the-shelf) information technology computing.
  - a. The exported electronic ballot image records shall be in a publicly available, non-proprietary format.

- b. The records should be exported with a digital signature which shall be calculated on the entire set of electronic records and their associated digital signatures.
- c. The voting system vendor shall provide documentation about the structure of the exported ballot image records and how they shall be read and processed by software.
- d. The voting system vendor shall provide a software program that will display the exported ballot image records and that may include other capabilities such as providing vote tallies and indications of undervotes.
- e. The voting system vendor shall provide full documentation of procedures for exporting electronic ballot image records and reconciling those records within the paper records.

**C. Voting with a VVPRS**

- 1. LPS shall promulgate for voters instructions on how to use the VVPRS.
  - a. The VVPRS vendors shall provide, in plain language, any reference material requested by LPS to aid in the preparation of VVPRS instructions. These instructions shall be issued to each county board of election for board worker training.
  - b. Instructions for use of a VVPRS shall be made available prior to an election on the Division of Elections' website and shall be available to the voter at the polling place on an election day.
  - c. Prior to an election, the county commissioners of registration will provide demonstration machines at convenient locations throughout the county for voter education purposes.
  - d. The instructions for performing the verification process shall be made available to the voter on a location inside the voting machine. Where feasible, the instructions shall also be on the machine ballot face.
- 2. Voter privacy shall be preserved during the process of recording, verifying, and auditing ballot selections. This includes a voter who uses an audio voting device. Voters using an audio voting device shall also be able to verify votes privately and independently.

3. In any election where the ballot contains a language in addition to English, the paper record shall be produced in all such languages.
  - a. To assist with manual auditing, candidate names on the paper record shall be presented in the same language as used on the DRE summary screen.
  - b. Information on the paper record not needed by the voter to perform verification shall be in English.
4. The privacy of voters whose paper records contain an alternative language shall be maintained.
5. The paper records shall distinguish between accepted and non-accepted ballots.
  - a. The voter shall have the opportunity to accept or reject the contents of his or her paper record.
    - (1) If the voter rejects the contents of the paper record, he or she may recast the ballot up to two additional times. This procedure is consistent with current State law, which limits the amount of time a voter has to cast a ballot. (See N.J.S.A. 19:52-3).
    - (2) Before the voter causes a third and final paper record to be printed, the voter shall be presented with a warning notice on the machine that the selections on the DRE will be final. The voter will see and verify a printout of the votes, but will not be given additional opportunities to change any vote. The third ballot cast shall constitute the final and official ballot of such a voter.
    - (3) Upon rejecting a paper record, the voter shall be able to modify and verify the selections on the DRE without having to reselect all choices in all contests on the ballot.
    - (4) If a mechanical error in recording or printing a paper record occurs, the record shall be counted as a spoiled paper record. It will not be counted as one of the voter's three attempted votes.



- (5) The VVPRS shall be designed to indicate the paper record which the voter has identified and cast as his or her official ballot.

## V. Security and Reliability

- A. The VVPRS shall not be permitted to externally communicate with any system or machine other than the voting system to which it is connected.
- B. The VVPRS shall only be able to function as a printer; it shall not contain any other services (e.g., copier or fax functions) or network capability. The printer shall not contain any component with an external communication feature.
- C. The paper path between the printing, viewing, and storage of the paper record shall be protected and sealed from access, except by election officials authorized by each county commissioner of registration.
- D. All cryptographic software in the voting system shall be approved by the U.S. Government's Cryptographic Module Validation Program, if applicable, prior to being certified in New Jersey.
  1. As stated in the discussion portion of Section 7.9.3 of the United States Election Assistance Commission draft criteria for "Voter Verifiable Paper Audit Trail Requirement," "There may be cryptographic voting schemes where the cryptographic algorithms used are necessarily different from any algorithms that have approved CMVP (Cryptographic Module Validation Program) implementations, thus CMVP approved software should be used when feasible but is not required. The CMVP website is <http://csrc.nist.gov/cryptval>."
  2. The vendor shall provide a certification of CMVP approval, if applicable. If not applicable, the vendor shall provide a certification setting forth the reasons why CMVP approval does not apply.
- E. The printer shall be connected to the voting machine either by completely concealing the printer connection or via a security tag to prevent tampering.
- F. The DRE shall detect and notify the election officials at the polling place of any errors and malfunctions, such as paper jams or low supplies of consumables (e.g. paper) that may prevent paper records from being correctly displayed, printed, or stored.

- G. If a mechanical error or malfunction occurs (such as, but not limited to, a paper jam or running out of paper), the DRE and VVPRS shall suspend voting operations, not record votes, and present a clear indication of the malfunction to the voter and election officials.
- H. If the connection between the voting machine and the printer has been broken, the voting machine shall detect and provide notice of this event and record it in the DRE's internal audit log. Voting operations shall be suspended and no votes shall be recorded.
- I. If the voter's selections on the DRE do not match the paper record, then the DRE shall immediately be withdrawn from service.
  - 1. The affected voter shall be able to vote on another voting machine, if available, or by emergency ballot.
- J. The vendor shall provide to LPS documentation for the DRE and the VVPRS that includes procedures for the recovery of votes in case of a malfunction. LPS shall be responsible for disseminating this information to the county commissioners of registration.
- K. The vendor shall provide to LPS documentation for the DRE and the VVPRS that includes recommended procedures to enable the election officials to return a voting machine to workable status after the machine has malfunctioned, the printer needs to be replaced, or a voter has used it incompletely or incorrectly.
  - 1. These procedures shall not cause discrepancies between the tallies of the electronic and paper records.
  - 2. LPS shall be responsible for disseminating this information to the county commissioners of registration.
- L. Vendor documentation shall include procedures for investigating and resolving printer malfunctions including, but not limited to, printer operations, misreporting of votes, unreadable paper records, and process failures.
- M. If a machine malfunctions or becomes inoperable, voters will be entitled to vote by emergency ballots.

## **VI. Certification**

- A. A VVPRS shall conform to State requirements. These requirements shall include, but are not limited to, the submission to LPS of any and all reports concerning the VVPRS issued by a federally-certified Independent Testing Authority (“ITA”).
- B. The VVPRS shall be subject to examination by the State Voting Machine Examination Committee (“Examination Committee”). LPS, in its discretion, may also appoint or retain a technical advisor or a panel of technical advisors (“technical advisors”) to evaluate and test the VVPRS or assist the Examination Committee in its examination.
- C. Whether conducted by the Examination Committee, technical advisors, or a combination of both, the examination of the VVPRS shall include, but not be limited to, the functionality, security, durability, and accessibility of the system. This examination shall also include volume testing, which is the investigation of the system’s response to processing more than the expected number of ballots and/or voters or to any other similar conditions that tend to overload the system’s capacity to process, store, and report data.
  - 1. The vendor shall provide to the State, electronically and in hard copy, all use and technical specifications and documentation relating to the function of the VVPRS.
  - 2. The vendor shall submit a certification that the VVPRS satisfies the State’s criteria.
- D. A VVPRS shall not, at any time, contain or use undisclosed hardware or software. The only components that may be used in the system are components that have been tested and certified for use in the State.
- E. The vendor will be required to provide the source code for the DRE and the VVPRS to the State, and/or to place such source code in escrow, to allow for independent testing by the State, at its discretion. Upon request, the State will enter into a non-disclosure agreement with the vendor.
- F. The vendor will be responsible for the cost of any testing of the VVPRS that the State deems necessary to achieve certification.
- G. Vendor documentation shall include printer reliability specifications including Mean Time Between Failure estimates, and shall include recommendations for appropriate quantities of backup printers and supplies.

1. Mean Time Between Failures, which measures the reliability of a voting system device, is the average time that a component works without failure. It is the value of the ratio of operating time to the number of failures which have occurred in the specific time interval.

**VII. Pre-Election Procedures**

- A. A VVPRS's components shall be integrated into the existing local logic testing procedures performed by county election officials, which are performed in preparation for an election.

**VIII. Post-Election Procedures**

- A. The county commissioner of registration will be required to perform a full and complete examination of any machine that malfunctioned or became inoperable on an election day.
- B. Unless there is an amendment to the current statutory law, LPS will issue procedures for mandatory, post-election, random manual audits of election results. These procedures will be published for public comment prior to their effective date.
  1. These procedures will be consistent with the statutory impoundment period for voting machines following an election.
  2. The audit process shall be open for public observation.
- C. In the case of a recount, the votes cast on the paper records shall serve as the official ballot, pursuant to N.J.S.A. 19:48-1 and N.J.S.A. 19:53A-3.
- D. In case the machine cartridge becomes unreadable or is damaged for an audit or recount, the county commissioner of registration shall produce the ballot image audit log from the machine. The vendor shall provide to LPS documentation regarding the production of such audit log.
- E. The paper record shall be created such that its contents are machine readable for purposes of any recount, audit, or initial tallying of an election in the event that the machine cartridge containing the electronic record is not usable.
  1. The paper record shall contain error correcting codes for the purpose of detecting read errors. This may be done by barcode.
- F. If a county employs a "Continuous Spool" VVPRS, it shall conduct any audit or recount in accordance with the procedures established by LPS to fully protect the

secrecy of all votes cast. Such procedures may include, but not be limited to, cutting the spool-to-spool paper roll into individual paper records, and restricting public access to the uncut paper roll.

- G. The vendor shall provide to LPS written procedures to identify and resolve any discrepancy between an electronic record and its corresponding paper record. LPS shall be responsible for disseminating this information to the county commissioners of registration.
- H. The vendor shall provide written procedures for determining what constitutes clear evidence that a paper record is inaccurate, incomplete, or unreadable. LPS shall be responsible for disseminating this information to the county commissioners of registration.

LPS may, in its discretion, revise, amend, or otherwise modify any of the criteria set forth in this document.